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Class

EX-MERIDIAN

ALTITUDE, AZIMUTH AND STAR-FINDING TABLES

WITH DIAGRAMS FOR FINDING THE LATITUDE AND FACILITATING PLOTTING LINES OF POSITION AND GIVING NEW AND PRACTICAL METHODS FOR IDENTIFYING STARS IN CLOUDY WEATHER

LATITUDES 0°–65°; DECLINATIONS 0°–71° NORTH AND SOUTH

BY
LIEUTENANT-COMMANDER
ARMISTEAD RUST
U. S. NAVY

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PREFACE

In these Tables I have followed the arrangement of ordinary Azimuth Tables as that most convenient to Navigators, the plan adopted by Lieutenant J. F. R. Bateman, Royal Navy, and Captain James Bairnson in their excellent works. Other arrangements might have made the book smaller, but at the same time not so convenient.

As this is not a text-book, I have not taken up space with rules for the conversion of time, finding hour angles, and for plotting lines of position by the usual methods familiar to Navigators, which may be found in any work on navigation. Attention, however, is called to the use of Ex-Meridian Tables in connection with Commandant Marcq Saint-Hilaire's method, the "New Navigation." In this method the "Reduction to the Meridian" is added to the meridian zenith distance to obtain the calculated zenith distance. For a full explanation the reader is referred to "Navigation and Nautical Astronomy," by Staff-Commander W. R. Martin, Royal Navy; "Navigation and Compass Correction," by Commander W. C. P. Muir, U. S. Navy, and "Explanation of the Method of the New Navigation," by Naval Instructor J. R. Walker, Royal Navy.

Every care has been taken to guard against errors, and the tabulated "First Reductions" have been compared, as far as practicable, with the results given in Bairnson's Tables and other works.

The methods for the identification of stars here given are very simple and will at times be found most useful.

In the accompanying plates I have introduced a number of new diagrams which I believe will be found upon trial more convenient than the corresponding tables, which in some cases have been also inserted. In using the plates no interpolation is necessary.

A few examples have been worked to illustrate the use of the various tables and diagrams.

In the preparation of this book and plates I have to acknowledge the assistance received from the following works:

Chauvenet's "Astronomy;" Chauvenet's "Trigonometry."

Rice and Johnson's "Differential Calculus."

Bairnson's "Ex-Meridian Tables."

"Short Method Ex-Meridian Tables," by Lieutenant J. F. R. Bateman, R.N.

"Notes on Navigation," by Commander P. F. Harrington, U. S. Navy.

Coffin's "Navigation."

190830

Bowditch's "American Practical Navigator."

"Azimuth Tables," — Hydrographic Office.

"Ex-Meridian Tables," by Brent, Walter, and Williams.

Chambers' "Mathematical Tables."

"The Practice of Navigation," by Lieutenant Henry Raper, Royal Navy.

"Navigation and Nautical Astronomy," by Staff-Commander W. R. Martin, R.N.

"A Companion to the Epitome of Navigation," by Captain H. S. Blackburne.

"Navigation and Nautical Astronomy," by J. Gill, F.R.A.S.

"Ex-Meridian Tables for Sun or Star," by Captain A. J. MacHattie.

"Navigation and Compass Correction," by Commander W. C. P. Muir, U. S. Navy.

Lecky's "General Utility Tables."

"Nautical Tables for Ex-Meridian Observations," by Bossen and Mars.

"Solving the Ex-Meridian Problem on Kinematic Principles," by H. B. Goodwin, Royal Navy.

This last book was received as these Tables were going to press, and I find that Table V is practically the same as the table given by Mr. Goodwin. His rules for finding the "First Reduction" are:

"(1) With latitude, declination, and half hour angle, take from the Azimuth Tables of Burdwood, Davis, or Goodwin the approximate Azimuth.

"(2) With the Azimuth so obtained, and latitude, take out 'rate of change' from the Table.

"(3) Multiplying this rate by the number of minutes of time in the whole hour angle we have the 'Reduction.'"

It may be shown from formulas (22) and (23) that $C_{\frac{t}{2}}^1 = \frac{1}{2} C_t^1$ hence, $\Delta_t h = C_t^1 \times \frac{t}{2} = \frac{1}{2} C_t^1 \times t = C_{\frac{t}{2}}^1 \times t$, that is, rule (3) gives the same value for the "First Reduction" as that given in the text.

Mr. Goodwin's pamphlet will be found a most useful addition to the library of every Navigator.

For the Table giving the values of "B" used in the identification of stars, I am indebted to Professor H. L. Rice, U. S. Navy, and also for the formula by which Table VII was computed, and to Commanders W. C. P. Muir and T. C. Fenton, U. S. Navy, for reviewing the text.

ARMISTEAD RUST,
Lieut.-Commander, U. S. Navy.

WASHINGTON, D. C., *July* 25, 1908.

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N. B.—The plates will be found at the end of the volume. While it is not advisable to remove the plates from the book for fear of losing them, it will be found convenient in practice and tend to preserve the plates to have an extra set pasted on heavy cardboard for every-day use.

Additional sets of plates may be obtained for $1.00 per set.

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Explanation of the Tables.

In the astronomical triangle PMZ, P is the elevated pole, M the position of the observed body, Z the zenith of the observer, L his latitude, d the declination and h the altitude of the observed body; $90° - h$ = the zenith distance of this body. Let h_o = the meridian altitude of M, then $90° - h_o$ = meridian zenith distance of M.

The reduction to the meridian is that arc which applied to the true altitude of an observed body will give the meridian altitude of that body at the place of observation.

Delambre's formula for the reduction to the meridian is:

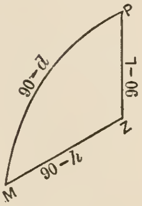

FIG. 1.

(1) Reduction to the meridian (in seconds of arc) =

$$\pm \frac{\cos L \cos d}{\sin (L \overset{\sim}{+} d)} \times \frac{2 \sin^2 \frac{1}{2} t}{\sin 1''} - \left(\frac{\cos L \cos d}{\sin (L \overset{\sim}{+} d)}\right)^2 \times \frac{2 \sin^4 \frac{1}{2} t \cot (L \overset{\sim}{+} d)}{\sin 1''},$$

where t is in seconds of time.

The positive sign for the first term corresponds to an observation near the upper transit and the negative sign to an observation near the lower transit, when the hour angle is reckoned from the lower branch of the meridian. The upper sign in the expression $(L \overset{\sim}{+} d)$ for the zenith distance corresponds to a case when the latitude and the declination are the same name, and the lower sign when they are of contrary names, or for lower transit.

The first term of (1) is the first reduction to the meridian

ERRATA.

Page vii, line 18, insert comma after "upper transit," and in line 19 omit comma after "lower transit."

Page x, line 6 from bottom, insert semicolon after "observed body."

Page xii, last line, "latitude" should be "altitude."

Page xxiv, line 2, "Eriadni" should be "Eridani."

Raper's formula for the second reduction to the meridian is

(7) Sin (second reduction) $= K \sin^2 \Delta_t h \tan h_o = \theta$,

where K is a constant and $\log K = 9.6990$; hence,

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Explanation of the Tables.

In the astronomical triangle PMZ, P is the elevated pole, M the position of the observed body, Z the zenith of the observer, L his latitude, d the declination and h the altitude of the observed body; $90° - h$ = the zenith distance of this body. Let h_o = the meridian altitude of M, then $90° - h_o$ = meridian zenith distance of M.

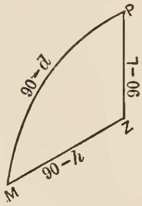

Fig. 1.

The reduction to the meridian is that arc which applied to the true altitude of an observed body will give the meridian altitude of that body at the place of observation.

Delambre's formula for the reduction to the meridian is:

(1) Reduction to the meridian (in seconds of arc) =

$$\pm \frac{\cos L \cos d}{\sin (L \overset{\sim}{+} d)} \times \frac{2 \sin^2 \frac{1}{2} t}{\sin 1''} - \left(\frac{\cos L \cos d}{\sin (L \overset{\sim}{+} d)}\right)^2 \times \frac{2 \sin^4 \frac{1}{2} t \cot (L \overset{\sim}{+} d)}{\sin 1''},$$

where t is in seconds of time.

The positive sign for the first term corresponds to an observation near the upper transit and the negative sign to an observation near the lower transit, when the hour angle is reckoned from the lower branch of the meridian. The upper sign in the expression $(L \overset{\sim}{+} d)$ for the zenith distance corresponds to a case when the latitude and the declination are the same name, and the lower sign when they are of contrary names, or for lower transit.

The first term of (1) is the first reduction to the meridian and the second term the second reduction:

(2) Reduction to meridian = ± first reduction − second reduction. If t be expressed in minutes of time, the first reduction may be reduced to the form

$$\text{(3) First reduction} = \pm \frac{1''.96349 \cos L \cos d}{\sin (L \overset{\sim}{+} d)} \times t^2.$$

Let t = 1 minute.

$$\text{(4) First reduction} = \triangle_1 h = \pm \frac{1''.96349 \cos L \cos d}{\sin (L \overset{\sim}{+} d)}$$

= change in altitude in one minute from meridian passage in seconds of arc; $\triangle_1 h$ is constant for any given latitude and declination. Then for any hour angle t

(5) First reduction $= \pm \triangle_1 h \times t^2$, in seconds of arc.

Let $\triangle_t h$ = first reduction in minutes of arc, then

$$\text{(6) } \triangle_t h = \pm \frac{\triangle_1 h \times t^2}{60}.$$

Raper's formula for the second reduction to the meridian is

(7) Sin (second reduction) $= K \sin^2 \triangle_t h \tan h_o = \theta$,

where K is a constant and $\log K = 9.6990$; hence,

(8) Second reduction = $\sin^{-1} \theta$ and
(9) Reduction to the meridian = $\pm \triangle_t h - \sin^{-1} \theta$.

The values of $\triangle_t h$ are given in the tables opposite the respective hour angles, in minutes and seconds, and Plate I gives the values of the second reduction corresponding to any given meridian altitude and first reduction.

TABLE V.

Altitude-Azimuth Table.

From this table the true azimuth may be obtained from the change of altitude in one minute.

From No. 285, Chauvenet's Trigonometry (10th edition), we have:

(10) $\triangle h = \cos Z \triangle L + \cos M \triangle d - \cos L \sin Z \triangle t$.

Let L and d be constant, then

(11) $\triangle h = - \cos L \sin Z \triangle t$. If $\triangle t$ = one minute in time, we have

(12) $\triangle h = - 15 \cos L \sin Z$, corresponding to the hour angle t, which gives the azimuth Z.

Denote this value of $\triangle h$ by C_t^1, then

(13) $C_t^1 = - 15 \cos L \sin Z$ = the change in altitude in one minute corresponding to the hour angle t, which is also the error in the altitude or the first reduction due to an error of one minute in the hour angle at the hour angle t corresponding to the azimuth Z.

Table V was computed from formula (13). When $Z = 90°$;

(13*a*) $C_t^1 = - 15 \cos L$.

TABLE VI.

Error in the First Reduction due to an Error in the Latitude used in the Computation.

This table was computed from the formula

(14) $\triangle h = \triangle L \, (1 - \cos Z)$ derived from the formula for Table VII.

TABLE VII.

Error in the Latitude due to an Error in the Latitude used in the Computation.

The formula deduced by Professor H. L. Rice, U. S. Navy, is

(15) $$\triangle L_1 = 2 \triangle L_0 \sec Z \sin^2 \frac{Z}{2} \left\{ 1 + \triangle L_0 \tan h \cos^2 \frac{Z}{2} \right\},$$

h being the observed altitude. $\triangle L_0$ in the parenthesis must be expressed in radians. For the practical purposes of navigation at sea we may neglect the second term in the parenthesis, and we have

(16) $\triangle L_1 = 2 \triangle L_0 \sec Z \sin^2 \frac{Z}{2}$, from which Table VII was computed. In this formula $\triangle L_0$ = the difference between the latitude by observation and the latitude by dead reckoning.

$\triangle L_1$ = correction to be applied to the computed latitude.

Explanation of the Plates.

PLATE I.

Diagram for the Second Reduction to the Meridian.

This diagram shows the value of the second reduction computed by Raper's formula: sin (second reduction) = $K \sin^2$ (first reduction) × tan (meridian altitude), where $\log K = 9.6990$.

PLATE II.

Altitude-Azimuth Diagram.

This diagram expresses graphically formula (13), (23) and Table V, and may be used with Prestel's method for finding the approximate latitude near the prime vertical.

PLATE III.

Time-Azimuth Diagram.

We have from (11) $\triangle h = -\cos L \sin Z \triangle t$.

Let $\triangle h = 1'$ of arc, then

(17) $\triangle t = -4 \sec L \operatorname{cosec} Z$, where $\triangle t$ is the number of seconds of time necessary to change the altitude one minute. Plate III shows formula (17).

PLATES IV AND V.

Error in the Latitude due to an Error of One Minute of Time in the Hour Angle or Longitude.

We have (11) $\triangle h = -\cos L \sin Z \triangle t$; if $\triangle t = 1$ minute in time, $\triangle h = -15 \cos L \sin Z$; but $\triangle L = \sec Z \triangle h$, hence

(18) $\triangle L = -15 \cos L \tan Z$. Plates IV and V were constructed by this formula.

PLATE VI.

Star-finding Diagram.

Represents the formulas

(19) $\sin Z \cos h = \sin t \cos d$;

(20) $\sin Z \cos L = \sin M \cos d$.

To find the Star's Declination from the Diagram.

Enter with the azimuth on the margin; the intersection of the horizontal line through this point with the curve corresponding to the true altitude fixes a vertical line the intersection of which with the horizontal line corresponding to the hour angle previously found, determines the curve corresponding to the declination of the body.

The Use of the Tables.

To find the latitude it is necessary to know

1. The latitude by dead reckoning = L.
2. The declination at time of observation = d.
3. The hour angle at time of observation = t.
4. The true altitude of the observed body = h.

The reduction to the meridian is that arc which applied to the true altitude of an observed body will give the meridian altitude of that body at the place of observation.

$\triangle_t h$ = the first reduction to the meridian, in minutes, for the hour angle of observation, t.

(2) Reduction to meridian = ± first reduction − second reduction.
Reduction to meridian = $\pm \triangle_t h$ − second reduction.

The first reduction, $\triangle_t h$, is found on the page for the latitude by dead reckoning (to the nearest degree), under the declination of the body (to the nearest degree), and opposite the hour angle.

If the exact hour angle is not found in the table, correct by simple interpolation for the odd minutes and decimals.

The correction thus found will be sufficiently exact for practical purposes, except when the meridian zenith distance is small or the hour angle large; then the hour angle must be corrected by Table V, or it may be readily computed by formula:

$$(6) \quad \triangle_t h = \pm \frac{\triangle_1 h \times t^2}{60}.$$

Formula (6) may be used to find the first reduction when the hour angle of the body exceeds the tabular hour angle.

$\triangle_1 h$ = the change in altitude in one minute from meridian passage with its logarithm, is given for this purpose; then

$$(21) \quad \text{Log} \triangle_t h = 2 \log t + \log \triangle_1 h + 8.22185 \ (\text{colog } 60).$$

When very exact results are desired the corrections for the minutes of declination and latitude may be made with the aid of Table VI.

In each column of declination is given the "limit" of the hour angle for which the value of the second reduction is less than one minute, about 45 seconds. The second reduction, however, may be readily found from Plate I by entering with the meridian altitude at the bottom and the first reduction on the curves. The meridian altitude is given in each column of declination for this purpose.

When the altitude was observed near the upper transit, add the reduction to the meridian to the true altitude of the observed body when near the lower transit, subtract the reduction (first and second combined) from the true altitude; the result is the meridian altitude of the body at the place of observation, and if the sun was observed, the latitude found must be corrected for the run to noon in order to find the latitude at noon.

TABLE I.

LOGARITHMS OF NUMBERS FROM 0 TO 999.

This table may be used to find the logarithm of a number of five figures or to find to five places the number corresponding to any given logarithm by using the proportional parts.

To find the logarithm of a number of five figures.

RULE. To the logarithm of the first three figures add the product of the last two figures multiplied by the proportional part found opposite the first three figures after pointing off seven places from the right.

EXAMPLE: — Find the logarithm of 35.674.

35.6	log	1.55145	.00122
		.00090	.74
35.674	log	1.55235	488
			854
			.0009028

RULE. To find to five places the number corresponding to a given logarithm.

Find the logarithm next less than the given logarithm and take out the corresponding number for the first three figures. Subtract this logarithm from the given logarithm and divide the remainder by the proportional part opposite the first three figures, to two places, and annex the quotient to the right of the three figures already found; point off from the left the whole number determined by the characteristic.

EXAMPLE: — Find the number corresponding to log 3.79643.

6250.0	log	3.79588	$\frac{55}{70} = .78$
6257.8	log	3.79643 (given)	
	Diff.	55	Required number = 6257.8

TABLES II, III, IV.

For correcting the observed altitudes of the sun and stars. First apply the index correction, then the corrections from the tables.

TABLE V.

ALTITUDE-AZIMUTH TABLE AND THE ERROR IN THE FIRST REDUCTION DUE TO AN ERROR OF ONE MINUTE IN THE HOUR ANGLE.

To find the azimuth.

It is necessary to know the change of altitude in one minute corresponding to the hour angle of observation. Now we have

(6) $\triangle_t h = \pm \frac{\triangle_1 h \times t^2}{60}$ in minutes of arc, t being in minutes of time.

Differentiating, $\triangle_1 h$ being constant,

$$d\,(\triangle_t h) = \pm \frac{\triangle_1 h \times t}{30}\,dt.$$

If $dt = 1$ minute of time, then $d\,(\triangle_t h) = \pm \frac{\triangle_1 h \times t}{30}$ = the change in altitude in one minute or rate of change per minute corresponding to the hour angle t and the azimuth Z.

Denote this by C_t^1. Then

$$C_t^1 = \pm \frac{\triangle_1 h \times t}{30}; \tag{22}$$

hence to find the change of altitude in one minute, multiply the change of altitude in one minute from meridian passage ($\triangle_1 h$) for the given latitude and declination by the hour angle in minutes and decimals and divide by 30. With this number, C_t^1, enter Table V or Plate II with the latitude for the azimuth.

The first reduction may also be found thus:

$$\triangle_t h = \pm \frac{\triangle_1 h \times t^2}{60} = \pm \frac{\triangle_1 h \times t}{30} \times \frac{t}{2}\text{; hence from (22)} \tag{6}$$

$$\triangle_t h = \pm C_t^1 \times \frac{t}{2}. \tag{23}$$

Therefore, find the change in altitude in one minute corresponding to the whole hour angle of the body and multiply this by one-half of the hour angle of the body.

If the declination is used instead of the latitude, the position angle, M, will be found in place of the azimuth in Table V and Plate II.

Table V also shows the error in the first reduction or the altitude due to an error of one minute in the hour angle, and may therefore be used, when the azimuth is known, for correcting the first reduction for the odd minutes and decimals of hour angle. That is, when the azimuth has been found from the Azimuth Tables, enter Table V with the azimuth and latitude, multiply the value of C_t^1 thus found by the minutes of hour angle, and apply the result to the first reduction corresponding to the tabular hour angle. When formula (22) is used to find the azimuth this value of C_t^1 should be used for correcting $\triangle_t h$ for the odd minutes of hour angle.

TABLE VI.

Error in the First Reduction due to an Error in the Latitude used in the Computation.

This table is used to correct the first reduction for the difference between the latitude by dead reckoning and the tabular latitude for which the first reduction was taken out, but is only needed when great accuracy is required.

The way to apply the correction to the first reduction, $\triangle_t h$, may be easily determined by looking on the page for the next degree of latitude in the same declination column to see whether the first reduction increases or decreases with an increase of latitude, and in the same manner determine the sign for the correction for minutes of declination which may be found from this table as there directed. All corrections should be made to $\triangle_t h$ before this is applied to the latitude.

TABLE VII.

ERROR IN THE LATITUDE DUE TO AN ERROR IN THE LATITUDE USED IN THE COMPUTATION.

Enter with the azimuth and the difference between the latitude used and the latitude by observation. The correction found must be so applied to the latitude by observation as to bring this latitude numerically between the true latitude and the latitude by dead reckoning used; thus, D.R. – Obs. – True, or True – Obs. – D.R.; that is:

1. When the latitude by D.R. is greater than that by observation, subtract the correction from the latter.
2. When the latitude by D.R. is less than that by observation, add the correction to the latter.

Use of the Plates.

PLATE I.

DIAGRAM FOR THE SECOND REDUCTION TO THE MERIDIAN.

Enter with the meridian altitude corresponding to the given latitude and declination at the bottom of the diagram. The intersection of the vertical line at this point with the curve corresponding to the first reduction gives the second reduction on the margin.

PLATE II.

ALTITUDE-AZIMUTH DIAGRAM.

This diagram corresponds to Table V, but it is not on a sufficiently large scale for interpolating for the odd minutes of hour angle, except the enlarged portion, which includes azimuths up to 14°.

To find the azimuth, first find C_t^1 (see formula (22), Table V) and enter with C_t^1 and the latitude. If the declination is used instead of the latitude, the position angle, M, will be found in place of the azimuth.

From formula (13) we have

(24) $\text{Sin } Z = -\frac{C_t^1}{15} \sec L$. The value of C_t^1 may be computed from formula (22) as long as the hour angle does not exceed the "limit" given in the tables; that is, the second reduction must be practically zero. Plate II expresses formula (24).

The value of C_t^1 may be found in practice by dividing the difference between two altitudes by the number of minutes in the elapsed time; and correcting the quotient for the run of the ship in the interval. See remarks under (25).

The azimuth obtained from this diagram, being negative, must be reckoned from the depressed pole, or its supplement from the elevated pole.

From an inspection of the Azimuth Tables these rules will be seen to hold good, the azimuth being always less than 90°.

1. Mark the azimuth east or west like the hour angle.
2. When the latitude is 0° give the azimuth the same name as the declination.
3. When the latitude and the declination are of the same name and the latitude is less than the declination, the azimuth has the same name.
4. When the latitude and declination are of the same name and the declination less than the latitude, the azimuth is of the contrary name, for the limit of the diagram, that is, until the body reaches the prime vertical, after which it is of the same name.
5. When the latitude and declination are of contrary names the azimuth has the same name as the declination.

When the body is so near the prime vertical as to cause any doubt, refer to Table IX, "Altitudes on the Prime Vertical"; when the altitude is greater than the tabular altitude, the azimuth is of the contrary name; when less, of the same name. Plate II was designed for use with "Ex-Meridian Altitudes" and should be used with great care when the body is near the prime vertical, as here a small error in C_t^1 will cause a large error in the azimuth.*

To find the Hour Angle of an Observed Body and the Latitude when the Time is not known.

Formula (22) $C_t^1 = \pm \frac{\triangle_1 h \times t}{30}$, from which

(25) $t = \pm \frac{C_t^1 \times 30}{\triangle_1 h}$,

from which t may be found in minutes when it does not exceed the limits given, that is, when the second reduction is practically zero, and when the conditions are good the longitude may be found with considerable accuracy.

By dividing the difference of altitudes by the interval we obtain the change in altitude in one minute, due to combined motion of ship and body, which corrected for run gives C_t^1.

Unless the ship be steering a course at right angles to the direction of the body, the change in altitude in one minute must be corrected for the run of the ship; that is, if D minutes is the speed of the ship per hour, then D seconds is the speed per minute and the correction = D'' cos (course − azimuth). Enter the Traverse Tables with D'' as a distance and $(C - Z)$ as a course, then the correction is found in the latitude column, to be subtracted from the observed change of altitude per minute when the ship is moving towards the body, and to be added when moving away from the body; in other words, when $(C - Z)$ is less than 90°, subtract; when $(C - Z)$ is greater than 90°, enter with the supplement of $(C - Z)$ and add the correction. The above rules apply when the body is rising; when falling, add when approaching and subtract when separating.

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* To compute C_t^1 on, or very near, the prime vertical: Multiply the natural cosine of the Latitude by 15. See (13*a*).

To make this method of any value the following must be observed:

1. The altitudes must be observed with the greatest accuracy, with an interval of not less than five minutes between them.
2. The hour angle must be within the "limit" so that the second reduction may be regarded as zero.
3. The correction for run must be accurately known and correctly applied.
4. The watch time corresponding to the hour angle t is the mean of the watch times of the two observations.

The declination of the body is supposed to be constant in the interval between the sights, which is practically true for the sun and planets; but when the moon is used a correction must be made for the change in declination, and this applies also when Plates II and III are used for finding the azimuth of the moon.

Ordinarily the value of $\triangle_1 h$ to be used in formula (24) may be found from those given in the tables by interpolating for minutes of latitude and declination. Where greater accuracy is required the value of $\triangle_1 h$ should be found from formula (4), as, for instance, when (25) is used for finding the longitude.

PLATE III.

TIME-AZIMUTH DIAGRAM.

This is sometimes more convenient than Plate II for finding the azimuth and position angle. Near the prime vertical it is necessary for the time to change the altitude one minute to be very accurately known. Rules 1, 2, 3, 4 and 5 and remarks under Plate II, apply to Plate III.

Equation of Equal Altitudes.

Mr. G. W. Littlehales, Hydrographic Engineer, U. S. Hydrographic Office, has derived the following formula for this equation in which it is necessary to know the value of the position angle:

$$(26)\quad t.dt = -\frac{t}{15}\sec d \cot M\, dd.$$

In (26) $t = \frac{1}{2}$ the elapsed time between the A.M. and P.M. altitudes.

Quoting from Mr. Littlehales' article in No. 128 of the U. S. Naval Institute:

"This equation, besides being much easier to compute, is rid of the ambiguities of sign which attach to each of the two terms that compose the right-hand member of the usual form of the equation. It will be observed that in this form the correction does not change sign unless the position-angle changes from a value less than 90° to a value greater than 90°; and that when the position-angle has a value of 90°, the 'equation' vanishes. We may, therefore, lay down the simple rule that, for values of the position-angle less than 90°, the correction should be added when the polar distance is increasing and subtracted when the polar distance is decreasing; and, for values of the position-angle greater than 90°, the reverse is the case."

On Plates II and III, if the declination be used instead of the latitude, then the position angle or its supplement will be found in place of the azimuth, and the same rule applies to the azimuth tables, where by interchanging the latitude and the declination the position angle is found in place of the azimuth.

The position angle may also be found from Plate VI. When the hour angle is small it is better to use Plate III, as it is seen that with the aid of the vertical lines for interpolating the exact value of the position angle may be easily determined.

Example 1. — Niquero, Cuba, February 5, 1908, lat. 20° 02′ 30″ N., long. 77° 35′ 20″ W., observed the following altitudes ⊙ for chronometer error. $C - W = 5^h 22^m 47^s$ A.M.; $C - W = 5^h 22^m 45^s$ P.M.

A.M. Watch Times.	A.M. Altitudes.	P.M. Watch Times.	P.M. Altitudes.
h. m. s.		h. m. s.	
8 55 36.5	63° 00′	3 04 33.3	64° 00′
55 55.5	10	04 59.6	50
56 28.5	20	05 25.7	40
56 55	30	05 53.6	30
57 19.5	40	06 18	20
57 48	50	06 44	10
58 14.3	64° 00	07 09.3	63° 00

The altitude here changes 30′ in 156 seconds, or 1′ in 5.2 seconds, or in one minute the altitude changes 11.54′ and we find $M = 53°$.

We find middle chronometer time =
5 24 09 Dec. = 16° 11′ 14″ S.
Eq. E.A. – 07.2° Eq. time 14 07
5 24 01.8 Corrected for local
Eq. t – 14 07 apparent noon. Eq. time
5 09 54.8 to be subtracted from mean time.
Long. 5 10 20 West. H.D. for Dec., + 44.83″.
Chro. 0 00 25.2
slow G.M.T.

Elapsed time = 6 08 56
t = 3 04 28
= 3.0744 hrs.

	$t = 3.0744$	log 0.4878
	15	colog 8.8239
The same result was	$d = 16° 11' 14''$	sec 0.0176
obtained by the or-	$M = 53°$	cot 9.8771
dinary method.	$dd = + 44.83''$	log 1.6516
	$t.dt = 7.21$ sec	log 0.8580

Hence Eq. E.A. = – 7.21 sec.

As the log cot M is the same as the log cot $(180° - M)$ it is immaterial which is used in the computation, but we must know whether M is greater or less than 90°

to determine the sign of the correction $t.dt$, which is easily determined from Fig. 2 or getting the approximate value from the Azimuth Tables.

Fig. 2 is the celestial sphere projected on the plane of the horizon. P, elevated pole; Z, zenith of the observer; WQE, equator; and WZE, the prime vertical.

1. Let L and d have the same name and $d > L$; then the value of M varies from 0° where the body crosses the lower branch of the meridian to 180° where it crosses the upper branch, being 90° when the diurnal circle is tangent to the vertical circle at its maximum elongation.
2. Let L and d have the same name and $L > d$. In this case M' varies from its maximum when in the horizon to 0° when on the meridian.
3. Let L and d be of contrary names, then M'' is always less than 90° while the body is above the horizon.

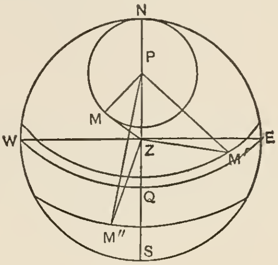

Fig. 2.

PLATES IV AND V.

Error in the Latitude due to an Error of One Minute of Time in the Hour Angle or Longitude.

Plate V is a continuation of Plate IV. These plates afford a convenient means of plotting lines of position without the aid of parallel rulers or protractors of any kind, and are therefore a great convenience on board ship. After finding the ship's position for a given longitude, assume an error of one minute of time or 15′ of arc in the longitude, with the latitude and azimuth of the body find the correction from Plate IV or V, which lay off on the new meridian so as to make the line of position thus established come at right angles to the line of azimuth passing through the body.

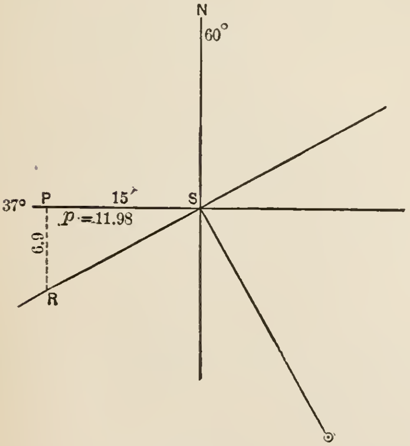

Fig. 3.

Example 2. — Let S be the position of the ship in lat. 37° N., long. 60° W., the sun bearing S. 30° E., plot the line of position.

In the figure NS is the meridian. The line runs N. 60° E., or S. 60° W. Lay off $PS = 15'$ of longitude on the parallel 37°. From Plate V, $\Delta L = 6.9'$, take on the meridian through P, $PR =$

$\triangle L = 6.9'$, then RS is the required line of position, which is easily proved thus: $\tan Z = \dfrac{PR}{p}$, where p = the departure corresponding to $PS = 15'$ longitude in latitude $37° = 11.98'$, and we find Z = S. 29° 57′ E.

If the chart used is on a large scale, make $PS = 5'$ of longitude, then $\triangle L = 2.3'$. If a small scale chart is used, make $PS = 30'$ and multiply $\triangle L$ taken from the plate by 2.

PLATE VI.

Star-finding Diagram.

To be used in connection with the Azimuth Tables and Plate II for the identification of stars in cloudy weather.

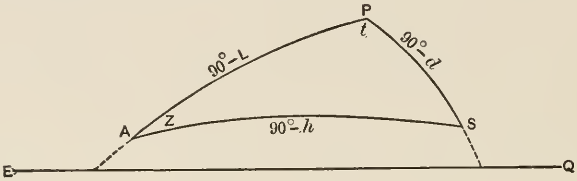

Fig. 4.

In Fig. 4, P is the elevated pole, A the zenith of the observer, and S the position of the star.

Given $AP = 90° - L$, $AS = 90° - h$, and Z = the azimuth; to find t = the hour angle and d = the declination.

Reduce the observed altitude and azimuth to true and find the local sidereal time at ship.

Shift the pole of the triangle PAS from P to A; then renaming the parts as shown in Fig. 5, we find the hour angle thus:

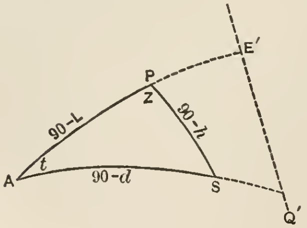

Fig. 5.

Enter the Azimuth Tables in the latitude of the ship with the azimuth as an hour angle and the altitude as a declination; the corresponding azimuth is the hour angle of the star; then

$$(27)\quad \cos d = \sin Z \cos h \operatorname{cosec} t.$$

Plate VI shows the relation expressed in formula (27) or

$$(28)\quad \sin t \cos d = \sin Z \cos h,$$

from which the declination is found after finding the hour angle from the Azimuth Tables, the azimuth having been observed or found from the azimuth diagram.

To find the star's declination from the diagram.

Enter with the azimuth on the margin; the intersection of the horizontal line through this point with the curve corresponding to the true altitude fixes a vertical line the intersection of which with the horizontal line corresponding to the hour angle previously found, determines the curve corresponding to the declination of the body.

This diagram also shows the relation

(29) $\text{Sin } Z \cos L = \sin M \cos d$, from which the position angle M of a given body may be found thus:

Enter with the azimuth on the margin; the intersection of the horizontal line through this point with the curve corresponding to the latitude fixes a vertical line the intersection of which with the curve corresponding to the given declination, determines the horizontal line corresponding to the position angle of the body.

Supplementary azimuths, hour angles, and position angles are given on the right-hand margin.

Ordinarily the azimuth may be observed with sufficient accuracy for the purpose of identification, but it is not always convenient to take the bearings, and conditions may be such as to make them inaccurate. In such cases take several altitudes, noting the time, and find C_t^1, the change in altitude in one minute, and then find the azimuth from Plate II. To be exact C_t^1 should be corrected for the run of the ship, but in identifying stars this correction may, as a rule, be neglected.

It is always best to take a compass bearing as a check, even though a rough one, as this, with the altitude and latitude, will enable the observer to decide whether the latitude and declination are of the same or contrary names. This is necessary in order to find the hour angle from the azimuth tables.

There will be no difficulty in determining the names of the declination except when the star is near the equator. After finding the declination it is well to verify the name by entering the Azimuth Tables with the hour angle and this declination to see whether the azimuth so found agrees with that used.

In all cases the name of the declination may be readily found from the following table for which the writer is indebted to Professor H. L. Rice, U. S. Navy.

VALUES OF *B*.

Altitudes	For Azimuths North toward West or North toward East.										Altitudes
	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	
10°	16°.0	16°.0	15°.9	15°.7	15°.4	14°.9	14°.1	12°.5	8°.9	0°.0	10°
20	14.0	13.9	13.8	13.4	12.9	12.1	10.8	8.6	5.1	0.0	20
30	12.0	11.9	11.7	11.3	10.6	9.6	8.2	6.1	3.3	0.0	30
40	10.0	9.9	9.6	9.2	8.5	7.5	6.2	4.4	2.3	0.0	40
50	8.0	7.9	7.7	7.2	6.5	5.7	4.6	3.2	1.7	0.0	50
60	6.0	5.9	5.7	5.3	4.8	4.1	3.2	2.2	1.1	0.0	60
70	4.0	3.9	3.8	3.5	3.1	2.6	2.1	1.4	0.7	0.0	70
80	2.0	2.0	1.9	1.7	1.5	1.3	1.0	0.7	0.4	0.0	80
90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	90
Altitudes	0°	10°	20°	30°	40°	50°	60°	70°	80°	90°	Altitudes
	For Azimuths South toward West or South toward East.										

Express the latitude in degrees and tenths as *B* in the table.
Mark north latitude + and south latitude −.
When the azimuth is found at the top of the Table *B* is +.
When the azimuth is found at the bottom of the Table *B* is −.
The declination has the sign of $B + \frac{\text{latitude}}{5}$.

Example 3. — At sea, February 26, 1901, 6.30 p.m., L.M.T., weather overcast and cloudy, observed the altitude of an unknown star of about the second magnitude, through a break in the clouds, 29° 30′ (true), bearing N. 74° W. (true). Lat. by dead reckoning 35° N., long. 60° W. What is the name of the star?

74° = 4 hrs. 56 min.

	h	m	s
L.M.T.	6	30	00
R.A.M.S.	22	22	33
Cor. G.M.T.		1	43
L.S.T.	4	54	16
Star H.A.	4	49	36
Star R.A.	0	04	40

Entering the Azimuth Tables (H.O. No. 120) in lat. 35°, latitude and declination same name, with 4 hrs. 56 min. as an hour angle and for 29° 30′ dec., we find the azimuth 72° 24′ = 4 hrs. 49 min. 36 sec. the required hour angle.

Then from Plate VI we find the declination = 28° 30′ N.

R.A. of star = 0 hrs. 04 min. 40 sec.

Dec. of star = 28° 30′ N. In the Nautical Almanac these correspond to α Andromedæ, R.A. 0 hrs. 03 min. 19 sec.

Dec. 28° 33′ N.

Example 4. — At sea, February 6, 1903, lat. 15° 53′ S., long. 38° 12′ W., observed the following altitudes of a star bearing about W.N.W. Cloudy weather with heavy sea and too much motion on the ship to obtain a bearing by compass. What star was observed?

Obs. altitudes		Watch times		
°	′	h	m	s
20	18	5	05	07
19	58		06	38
19	39		08	00

$C - W$ = 3 hrs. 8 min. 13 sec.
Chro. fast G.M.T. 0 hrs. 20 min. 9 sec.

Correction for I.C., dip and refraction, − 7′ 00″.

In 2 min. 53 sec. change in altitude = 39′ and $C_t^1 = 13.52'$, and from Plate II, Z = N. 69° 35′ W. or S. 110° 25′ W.

To find the hour angle, enter H.O. No. 71 (Azimuth Tables), latitude 16°, declination 20°, contrary name (the corrected mean altitude being 19° 51′ 20″). We find that the hour angle 110° 25′ = 7 hrs. 21 min. 40 sec. is not given, so we enter with the supplement of this hour angle 4 hrs. 38 min. 40 sec., and the supplement of the corresponding azimuth, 115° 30′ or 64° 30′, is the hour angle required.

	h m s
w.t. (mean).	5 06 35
C. − W.	3 08 13
Chro.	8 14 48
Chro. Cor.	− 20 09
G.M.T.	19 54 39
R.A.M.S.	20 57 50.4
Cor. G.M.T	03 16.2
G.S.T.	16 55 45.6
Long.	2 32 48 (W)
L.S.T.	14 22 57.6
Star's H.A.	4 18 00
Star's R.A.	10 04 57.6

t = 64° 30′ = 4 hrs. 18 min.

Entering Plate VI with azimuth = S. 110° 25′ W.

Altitude = 19° 51′ 20″; hour angle 64° 30′; we find declination = 12° 30′ N. Check the declination and hour angle by entering the Azimuth Tables and we find the azimuth agrees with that used in the problem.

Example 5. — At sea, August 10, 1904, about 5.30 a.m., lat. 11° 37′ N., long. 81° 09′ W. Correction for dip, refraction and I.C. − 9′ 00″. Observed the following altitudes of a bright star bearing about E.S.E.

Watch times h m s	Obs. altitudes ° ′ ″
5 24 35	23 36 00
26 55	24 07 30
35 43	26 04 00

When the watch showed 5 hrs. 35 min. 43 sec. the G.S.T. was 8 hrs. 12 min. 17 sec. As the ship was rolling heavily no accurate bearing could be taken. What was the star?

It is evident from the approximate bearing and the altitude that the star is in south declination. When $d = 0$, meridian altitude $= 90° - L = 79° 23'$ in this case, evidently too great an altitude for this star to reach.

From the difference of altitudes divided by the number of minutes in the interval we find $C_t^1 = 13.3'$, and from Plate II we find $Z =$ S. 65° E.

	h	m	s	
G.S.T. of obs.	8	12	17	
Long. west	5	24	36	
L.S.T.	2	47	41	
Star's H.A.	3	52	16	(East)
Star's R.A.	6	39	57	

To find the hour angle in this case we must enter the Azimuth Tables with the supplement of the azimuth found from Plate II = 115° = 7 hrs. 40 min. as an hour angle, and in the 26 column we find 58° 04′ = 3 hrs. 52 min. 16 sec. for the hour angle of the star.

From Plate VI, with $Z =$ S. 65° E., altitude = 25° 55′, and hour angle = 58° 04′, we find declination = 16° 30′ S.

Star's R.A. 6 hrs. 40 min. 7 sec., Star's Dec. 16° 30′ S.

These correspond to α Canis Majoris (Sirius),

R.A. 6 hrs. 40 min., 55 sec., Dec. 16° 35′ S.

When the star is on or very near the meridian so that its hour angle is practically 0, the star's right ascension is equal to the local sidereal time, and its declination may be readily found by looking in the Ex-Meridian Tables in the latitude by dead reckoning for the meridian altitude of the star, and in the same column at the top will be found the declination. If the azimuth is so great that the hour angle must be taken into account in computing the right ascension, then proceed as in Examples 3, 4, and 5. Or having found the hour angle from the azimuth and altitude, we may take out the approximate correction from the Ex-Meridian Tables, which added to the observed altitude for upper passage, or subtracted for lower, will give the meridian altitude, from which the declination may be found as when the star is on the meridian.*

To Identify a Star with the Aid of a Great Circle Sailing Chart.

As azimuth tables for the higher declinations are not always available the following method is given.

If we use the Great Circle chart of the North Atlantic Ocean:

On the meridian of Greenwich, or any convenient meridian, mark the point S in a latitude equal to h, the true altitude of the star. Mark A, the position of the ship in latitude, L, and in longitude from S equal to the true azimuth

---

* When the star is near the prime vertical, find the Latitude in Table IX, and look for the altitude in the same line. The declination will be found at the head of the column, and the hour angle under this declination and in the same line as the altitude.

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of the star, *Z*. Find the Great Circle course and distance between *A* and *S* by the method of the chart. The course is the hour angle of *S* and the distance is the complement of the declination.

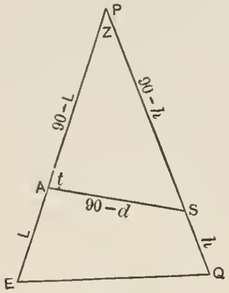

FIG. 6.

Local sidereal time = R.A. of star ± H.A. of star; hence apply the hour angle of the star to the L.S.T. at ship, subtracting when west and adding when east, and the result is the right ascension of the star, $d = 90° - AS$, and the star may be found in the Nautical Almanac.

It is evident from Fig. 6 that the azimuth of the star from *A* is the Great Circle course from *A* to *S* in latitude = *d*; hence the well-known rule for finding the Great Circle course from the Azimuth Tables:

"With the difference of longitude as an hour angle enter the latitude of departure and the Great Circle course will be found in place of the azimuth in the declination column corresponding to the latitude of destination."

When the latitude and the declination are of contrary names, proceed as directed on the chart for finding the course and distance between two places on opposite sides of the equator.

The following examples illustrate the use of the tables and plates.

EXAMPLE 6. — At sea, June 30, 1904, lat. 37° 33′ S., long. 24° 00′ E. by D.R., Local Ap. Time 0 hrs. 23 min., observed altitude sun's lower limb 29° 10′, height of eye 28.5 feet, declination 23° 11′ 48″ N. Find the latitude and plot the line of position.

From page 223, column 23, we have $\triangle_{24}h =$	+16′ 02″
Correction Table V for 1 min. H.A. . . .	− 1′ 15″
Correction Table VI	− 15″
$\triangle_t h =$	14′ 32″

$$\triangle_1 h = 1.66''$$

$$Ct^1 = \frac{1.66 \times 23}{30} = 1.27'$$

Obs. Alt. Sun's l.l. . . .	29°	10′	00″	
Cor. Table II		+ 9	05	
True Alt. Sun's c. . . .	29°	19′	05″	
$\triangle_t h$		+14	32	
Mer. Alt.	29°	33′	37″	
	90			
Mer. *Z*. Dist.	60°	26′	23″	S
Declination	23	11	48	N
Latitude	37°	14′	35″	S
Cor. Table VII . . .			−7	
True Lat.	37°	14′	28″	S

When *Z* and *M* are so small the corrections from Tables VI and VII may be omitted without any appreciable error.

From Plate II,
$Z = 6° 30'$
$M = 6° 00'$

From an inspection of the tables we see that an increase in both latitude and declination causes a decrease in $\triangle_t h$, and as *Z* and *M* are practically equal we may enter Table VI with 45′ and 6° and take out both corrections at once — 15″.

Lat. by D.R.	37°	33′	00″
Lat. by calc.	37	14	35
Diff.		18′	25″
Cor. Table VII . . .			7″

To be subtracted to make good the relation D.R. — Calc. — True.

Enter Plate IV with $Z = 6° 30'$ and $L = 37° 15'$; we find the error in latitude due to 15′ error in longitude = 1.33′; so as the sun is in the N.W. quadrant the line runs from N.E. to S.W. quadrant. Lay off 15′ long. to W'd and 1.33′ to the S'd and join the latter point with the assumed position of the ship, Fig. 7.

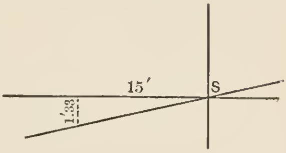

Fig. 7.

Example 7. — March 20, 1907, about 8.15 p.m., lat. 50° 14′ N., long. 1° 39′ W. by D.R., the observed altitude of Castor was 70° 01′ 02″ bearing to the S'd and W'd, chronometer time of observation 8 hrs. 49 min. 17 sec., chronometer fast of G.M.T. 0 hrs. 16 min. 7 sec. Find the latitude and plot the line of position.

Castor, Right Ascension 7 hrs. 28 min. 40 sec.
Declination 32° 05′ 36″ North.

	h	m	s
Chro. Time Obs.	8	49	17
Chro. Fast		16	07
G.M.T. Obs.	8	33	10
R.A.M.S.	23	47	28
Cor. for G.M.T.		1	24
G.S.T.	8	22	02
Long		6	36 W.
L.S.T.	8	15	26
Star's R.A.	7	28	40
Star's H.A.	0	46	46

Obs. Alt.	70°	01′	02″
Cor. Table II . . .		– 5	44
	69°	55′	18″
Red. to Mer	1	56	48
Mer. Alt.	71°	52′	06″
	90		
M.Z.D.	18°	07′	54″ N.
Dec.	32	05	36 N.
Latitude	50°	13′	30″ N.

On page 299 we find that for $t = 46.76$ min., $\triangle_t h$ is not tabulated, as 46. min. exceeds the limiting hour angle where the second reduction may be neglected.

From formula (21), $\triangle_t h = 126.1'$.

			$\triangle_t h$ =	+ 126.1′
We have $\triangle_1 h$ =	3.46″	log 0.53908	2d Red. =	– 7.1
t =	46.76	2 log 3.33974		+ 119.0′
	60	colog 8.22185	Table VI	– 2.2
$\triangle_t h$ =	126.1	log 2.10067	Total Red. =	+ 116.8′

On page 299 in column 32° we find meridian altitude = 72°, and from Plate I second reduction = 7.1′.

Formula (22) $$C_t^1 = \frac{\triangle_1 h \times t}{30} = \frac{3.46'' \times 46.76}{30} = 5.78'.$$

From Plate II, Z = S. 37° W.; $M = 27°$.

Table VI, cor. for 14′ lat. = – 2.82′; Table VI, cor. for 5.6 dec. = + .6′.

Total correction for minutes of lat. and dec. = – 2.22′.

With azimuth 37° enter Plate IV, and we find error in latitude for 15′ longitude = 7.24′. As the star is in the third quadrant the line must run through the second and fourth to N'd and W'd, and S'd and E'd. Lay off 15′ longitude to the westward of the position and 7.24′ latitude to the north. The line through this point and the ship's position is the line of position required.

Example 8. — August 6, 1907, lat. 59° 00′ S., long. 175° 27′ E., during evening twilight, observed altitude α Eriadni (Achernar) near lower transit 26° 52′ 00″, watch time 4 hrs. 31 min. 12 sec., $C - W$ = 0 hrs. 18 min. 7 sec., chronometer fast G.M.T. 0 hrs. 12 min. 42 sec., I.C. + 1′ 20″, height of eye 24 feet. Find the latitude.

	h	m	s	
Watch time . . .	4	31	12	
$C - W$	0	18	07	
Chro. Time	4	49	19	
Chro. Cor.		12	42	
G.M.T.	16	36	37	Aug. 5
R.A.M.S.	8	51	32.9	
Cor. G.M.T. . . .		2	43.3	
G.S.T.	1	30	53.2	
Long. East	11	41	48	
L.S.T.	13	12	41.2	
12 h. + Star's R.A.	13	34	15.1	
Star's H.A. = t =	0	21	33.9	

Achernar, R.A. 1 hr. 34 min. 15.1 sec.
Achernar, Dec. 57° 42′ 33″ S.
Polar Dist. 32° 17′ 27″ = p.

$$\text{Lat.} = h_o + p$$

Obs. Alt. 26° 52′ 00″ I. C. + 1′ 20″
Cor. . − 5 22 Tab. II. − 6 42
True Alt. 26° 46′ 38″ Cor. − 5′ 22″

$\triangle_t h$ . . − 4 40
Mer. Alt. = h_o = 26° 41′ 58″
p = 32 17 27
Latitude 58° 59′ 25″ South.

Page 357, column 57, $\triangle_1 h = 0.61''$, $C_t^1 = \dfrac{0.61'' \times 21.55}{30} = 0.44'$.

From Plate II, Z = S. 3½° W.; M = 3½°. M is so small that the correction for 42′ dec. is not sensible.

$$\begin{array}{rl} \triangle_{20} h & = 4'\ 02'' \\ \text{Cor. Table V for 1.55 min.} & = +\ 38 \\ \hline \triangle_t h & = 4'\ 40'' \end{array}$$

The star being near the lower transit, $\triangle_t h$ must be subtracted from the true altitude.

Example 9. — At Niquero, Cuba, March 5, 1908, approximate position, lat. 20° N., long. 77° 30′ W., observed the following altitudes of the sun's lower limb with artificial horizon:

	h	m	s		
Watch time	11	55	51.5	2 Altitude	126° 20′ 30″
	12	05	25		127 03 30

$C - W$ = 5 hrs. 4 min. 18 sec. Chronometer 49.76 sec. slow G.M.T. Find the longitude and the latitude.

We have, formula (25), $t = \dfrac{C_t^1 \times 30}{\triangle_1 h}$.

Let h' = lower altitude for upper transit.
T' = corresponding watch time.
h'' = higher altitude for upper transit.
T'' = corresponding watch time.

$$\frac{T' + T''}{2} = T_m = \text{middle watch time.}$$

$T'' \sim T' = i$ = interval between sights in minutes.
$h'' - h'$ = difference of altitudes in minutes of arc = D.

The hour angle t, found by the above formula (25), corresponds to T_m, and

$$C_t^1 = \frac{D}{i} = \frac{21.5' \times 60}{573.5}.$$

From page 121 we find $\triangle_1 h = 4.19''$, hence $t = \dfrac{21.5 \times 1800}{573.5 \times 4.19}$.

	h	m	s
T_m	=00	00	38.25
$C - W$	=5	04	18
Chro. Time	5	04	56.25
Chro. Cor.			+49.76
G.M.T.	5	05	46.01
Eq. Time (− M.T.) .		11	39.06
G.A.T.	4	54	06.95

G.A.T.	4	54	06.95
L.A.T.	11	43	53.4
Long.	5	10	13.55

Long. 77° 33′ 23″ West.

The true longitude is 77° 35′ 07″.

21.5	log	1.33244
1800	log	3.25527
573.5	colog	7.24147
4.19	colog	9.37779
$t = 16.11$	log	1.20697

$t = 16$ min. 06.6 sec. (East)*

To find the latitude corresponding to this hour angle it is necessary to find the altitude corresponding to the middle watch time.

It will be found more convenient, however, to find the hour angle corresponding to one of the altitudes by applying $\frac{1}{2}\, i$ to the hour angle t, already found.

Let t' = hour angle corresponding to h', the lower altitude.
t'' = hour angle corresponding to h'', the higher altitude.
Then $t' = t + \frac{1}{2} i$,
and $t'' = t - \frac{1}{2} i$; we have $i = T'' - T' = 9$ min. 33.5 sec.
$\frac{1}{2} i = 4$ min. 46.7 sec., and $t' = 20.9$ min.
$t'' = 11.33$ min.

2 obs. alt. =	126°	20′	30″
I.C.	+ 0		15
2)	126°	20′	45″
obs. alt.	63	10	23
Cor. S.D., etc. .		15	56
h'	63°	26′	19″
$\Delta_t h$		+30	34
h_o'	63°	56′	53″
	90°		
M.Z.D.	26°	03′	7″ North
Dec.	6	00	24 South
Latitude . . .	20°	02′	43″ North

$C_t^1 = \dfrac{20.9 \times 4.19}{.30} = 2.92$

Cor. for .9 min. $= 2.92 \times .9 = +\ 2.63'$
$\triangle_{20} h = 27'\ 56''$
Cor. $= +\ \ 2'\ 38''$
$\Delta_t h = 30'\ 34''$

2 obs. alt. . . .	127°	03′	30″
I.C.	+ 0		15
2)	127°	03′	45″
obs. alt.	63	31	53
Cor. S.D., etc. .		15	56
h''.	63°	47′	49″
$\Delta_t h$		+ 8	57
h_o''	63°	56′	46″
	90°		
M.Z.D.	26°	03′	14″ North
Dec.	6	00	24 South
Latitude . . .	20°	02′	50″ North

$C_t^1 = \dfrac{t \times \triangle_1 h}{30} = \dfrac{11.33 \times 4.19}{30} = 1.58'$

$1.58 \times 0.7 = 1'\ 06''$ = cor. to $\triangle_{12} h$
$\triangle_{12} h = \ \ 10'\ 03''$
Cor. $\ \ -1\ \ 06$
$\Delta_t h = \ \ 8'\ 57''$

The latitude from h'' is 20° 02′ 50″.
Mean latitude 20° 02′ 46″.
True latitude = 20° 02′ 40″ North.

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* If $\triangle_1 h$ be computed by formula (4), using the true latitude, we find $\triangle_1 h = 4'\ .177''$ and longitude = 77° 34′ 03.75″, only 1′ 03.75″ less than the true longitude.

Example 10. — U. S. S. Dubuque, at sea, off Cape Hatteras, June 23, 1908; lat. 33° 33′ N., long. 75° 26′ W., from A.M. time sight, observed the following altitudes of the sun's lower limb near noon:

	A.M.			P.M.	
	Watch.	Altitudes.		Watch.	Altitudes.
(1)	$11^{h}\ 47^{m}\ 08.5^{s}$	79° 19′ 30″	(3)	$12^{h}\ 05^{m}\ 52^{s}$	79° 38′ 50″
(2)	57 58	42 30	(4)	10 56.5	26 40

$C - W$ = 4 hrs. 55 min. 05 sec. Chronometer slow G.M.T. 0 hrs. 11 min. 40 sec. Sun's declination, corrected, 23° 26′ 20″ N. $\triangle_1 h = 8.57''$ computed by formula (4); height of eye 20 feet; corrected equation of time, to be subtracted from mean time = 1 min. 55 sec. Course North, true; speed, 10 knots. Find the Longitude and Latitude at noon.

ANSWERS.

From A.M. Observations.	From P.M. Observations.
Long. 75° 21.5′ West.	Long. 75° 22′ West.
Lat. from (1) 33° 31′ 45″ N.	Lat. from (3) 33° 30′ 57″ N.
" " (2) 33° 32′ 12″ N.	" " (4) 33° 32′ 00″ N.

As the ship was in the Gulf Stream during the interval between the A.M. time sight and noon, the difference of longitude is accounted for by the current.

If the ship change her longitude in the interval between the observations, the hour angle should be corrected for this difference when appreciable, that is, a westerly difference of longitude should be added to an easterly hour angle and be subtracted from a westerly hour angle and an easterly difference of longitude should be added to a westerly hour angle and be subtracted from an easterly one; or more briefly, when both are east or both are west, subtract; when one is east and the other west, add.

When the azimuth exceeds three or four degrees the line of position, corresponding to the latitude found, should always be drawn when very exact results are required.

TABLE I.

Logarithms of Numbers from 0 to 499.

No.	0	1	2	3	4	5	6	7	8	9	Prop. Part
0	0	00000	30103	47712	60206	69897	77815	84510	90309	95424	
10	00000	00432	00860	01284	01703	02119	02531	02938	03342	03743	415
11	04139	04532	04922	05308	05690	06070	06446	06819	07188	07555	379
12	07918	08279	08636	08991	09342	09691	10037	10380	10721	11059	344
13	11394	11727	12057	12385	12710	13033	13354	13672	13988	14301	323
14	14613	14922	15229	15534	15836	16137	16435	16732	17026	17319	298
15	17609	17898	18184	18469	18752	19033	19312	19590	19866	20140	281
16	20412	20683	20952	21219	21484	21748	22011	22272	22531	22789	264
17	23045	23300	23553	23805	24055	24304	24551	24797	25042	25285	249
18	25527	25768	26007	26245	26482	26717	26951	27184	27416	27646	234
19	27875	28103	28330	28556	28780	29003	29226	29447	29667	29885	222
20	30103	30320	30535	30750	30963	31175	31387	31597	31806	32015	212
21	32222	32428	32634	32838	33041	33244	33445	33646	33846	34044	202
22	34242	34439	34635	34830	35025	35218	35411	35603	35793	35984	193
23	36173	36361	36549	36736	36922	37107	37291	37475	37658	37840	185
24	38021	38202	38382	38561	38739	38917	39094	39270	39445	39620	177
25	39794	39967	40140	40312	40483	40654	40824	40993	41162	41330	170
26	41497	41664	41830	41996	42160	42325	42488	42651	42813	42975	164
27	43136	43297	43457	43616	43775	43933	44091	44248	44404	44560	158
28	44716	44871	45025	45179	45332	45484	45637	45788	45939	46090	153
29	46240	46389	46538	46687	46835	46982	47129	47276	47422	47567	148
30	47712	47857	48001	48144	48287	48430	48572	48714	48855	48996	143
31	49136	49276	49415	49554	49693	49831	49969	50106	50243	50379	138
32	50515	50651	50786	50920	51055	51189	51322	51455	51587	51720	134
33	51851	51983	52114	52244	52375	52504	52634	52763	52892	53020	130
34	53148	53275	53403	53529	53656	53782	53908	54033	54158	54283	126
35	54407	54531	54654	54777	54900	55023	55145	55267	55388	55509	122
36	55630	55751	55871	55991	56110	56229	56348	56467	56585	56703	119
37	56820	56937	57054	57171	57287	57403	57519	57634	57749	57864	116
38	57978	58093	58206	58320	58433	58546	58659	58771	58883	58995	113
39	59106	59218	59329	59439	59550	59660	59770	59879	59988	60097	110
40	60206	60314	60423	60531	60638	60746	60853	60959	61066	61172	107
41	61278	61384	61490	61595	61700	61805	61909	62014	62118	62221	104
42	62325	62428	62531	62634	62737	62839	62941	63043	63144	63246	102
43	63347	63448	63548	63649	63749	63849	63949	64048	64147	64246	99
44	64345	64444	64542	64640	64738	64836	64933	65031	65128	65225	98
45	65321	65418	65514	65610	65706	65801	65896	65992	66087	66181	96
46	66276	66370	66464	66558	66652	66745	66839	66932	67025	67117	95
47	67210	67302	67394	67486	67578	67669	67761	67852	67943	68034	92
48	68124	68215	68305	68395	68485	68574	68664	68753	68842	68931	90
49	69020	69108	69197	69285	69373	69461	69548	69636	69723	69810	88

Logarithms of Numbers from 500 to 999.—*Continued.*

No.	0	1	2	3	4	5	6	7	8	9	Prop. Part.
50	69897	69984	70070	70157	70243	70329	70415	70501	70586	70672	86
51	70757	70842	70927	71012	71096	71181	71265	71349	71433	71517	84
52	71600	71684	71767	71850	71933	72016	72099	72181	72263	72346	82
53	72428	72509	72521	72673	72754	72835	72916	72997	73078	73159	81
54	73239	73320	73400	73480	73560	73640	73719	73799	73878	73957	80
55	74036	74115	74194	74273	74351	74429	74507	74586	74663	74741	78
56	74819	74896	74974	75051	75128	75205	75282	75358	75435	75511	77
57	75587	75664	75740	75815	75891	75967	76042	76118	76193	76268	75
58	76343	76418	76492	76567	76641	76716	76790	76864	76938	77012	74
59	77085	77159	77232	77305	77379	77452	77525	77597	77670	77743	73
60	77815	77887	77960	78032	78104	78176	78247	78319	78390	78462	72
61	78533	78604	78675	78746	78817	78888	78958	79029	79099	79169	71
62	79239	79309	79379	79449	79518	79588	79657	79727	79796	79865	70
63	79934	80003	80072	80140	80209	80277	80346	80414	80482	80550	69
64	80618	80686	80754	80821	80889	80956	81023	81090	81158	81224	68
65	81291	81358	81425	81491	81558	81624	81690	81757	81823	81889	67
66	81954	82020	82086	81151	82217	82282	82347	82413	82478	82543	66
67	82607	82672	82737	82802	82866	82930	82995	83059	83123	83187	64
68	83251	83315	83378	83442	83506	83569	83632	83696	83759	83822	63
69	83885	83948	84011	84073	84136	84198	84261	84323	84386	84448	63
70	84510	84572	84634	84696	84757	84819	84880	84942	85003	85065	62
71	85126	85187	85248	85309	85370	85431	85491	85552	85612	85673	61
72	85733	85794	85854	85914	85974	86034	86094	86153	86213	86273	60
73	86332	86392	86451	86510	86570	86629	86688	86747	86806	86864	59
74	86923	86982	87040	87099	87157	87216	87274	87332	87390	87448	58
75	87506	87564	87622	87680	87737	87795	87852	87910	87967	88024	57
76	88081	88138	88196	88252	88309	88366	88423	88480	88536	88593	57
77	88649	88705	88762	88818	88874	88930	88986	89042	89098	89154	56
78	89209	89265	89321	89376	89432	89487	89542	89597	89653	89708	55
79	89763	89818	89873	89927	89982	90037	90091	90146	90200	90255	54
80	90309	90363	90417	90472	90526	90580	90634	90687	90741	90795	54
81	90849	90902	90956	91009	91062	91116	91169	91222	91275	91328	53
82	91381	91434	91487	91540	91593	91645	91698	91751	91803	91855	53
83	91908	91960	92012	92065	92117	92169	92221	92273	92324	92376	52
84	92428	92480	92531	92583	92634	92686	93737	92788	92840	92891	51
85	92942	92993	93044	93095	93146	93197	93247	93298	93349	93399	51
86	93450	93500	93551	93601	93651	93702	93752	93802	93852	93902	50
87	93952	94002	94052	94101	94151	94201	94250	94300	94349	94399	49
88	94448	94498	94547	94596	94645	94694	94743	94792	94841	94890	49
89	94939	94988	95036	95085	95134	95182	95231	95279	95328	95376	48
90	95424	95472	95521	95569	95617	95665	95713	95761	95809	95856	48
91	95904	95952	95999	96047	96095	96142	96190	96237	96284	96332	48
92	96379	96426	96473	96520	96567	96614	96661	96708	96755	96802	47
93	96848	96895	96942	96988	97035	97081	97128	97174	97220	97267	47
94	97313	97359	97405	97451	97497	97543	97589	97635	97681	97727	46
95	97772	97818	97864	97909	97955	98000	98046	98091	98137	98182	46
96	98227	98272	98318	98363	98408	98453	98498	98543	98588	98632	45
97	98677	98722	98767	98811	98856	98900	98945	98989	99034	99078	45
98	99123	99167	99211	99255	99300	99344	99388	99432	99476	99520	44
99	99564	99607	99651	99695	99739	99782	99826	99870	99913	99957	43

TABLE II.

Corrections for Dip, Refraction, Parallax, and Semi-Diameter and Dip and Refraction, to be applied to the Observed Altitude of the Sun's Lower Limb, or of a Star, to obtain the True Altitude. Barometer 30 inches = 76.2 centimeters. Thermometer 50° F. = 10° Centigrade = 8° R. Suns' Semi-Diameter, 16′ 02″.

Height of Observer's Eye, 20 feet = 6.1 metres.

Observed Altitude	Correction		Observed Altitude	Correction		Observed Altitude	Correction		Observed Altitude	Correction		Observed Altitude	Correction	
	Sun +	Star −		Sun +	Star −		Sun +	Star −		Sun +	Star −		Sun +	Star −
° ′	′ ″	′ ″	° ′	′ ″	′ ″	° ′	′ ″	′ ″	° ′	′ ″	′ ″	° ′	′ ″	′ ″
5 00	1 56	14 15	10 00	6 29	9 42	15 00	8 14	7 57	29 00	10 02	6 08	59 00	11 09	4 58
10	2 12	13 59	10	34	37	20	19	52	30 00	06	04	60 00	10	57
20	27	44	20	39	32	40	23	48	31 00	10	6 00	61 00	11	55
30	41	30	30	43	28	16 00	8 27	7 44	32 00	14	5 56	62 00	12	54
40	55	16	40	48	23	20	32	39	33 00	17	53	63 00	13	53
50	3 08	03	50	52	19	40	36	35	34 00	21	49	64 00	15	51
6 00	3 20	12 51	11 00	6 57	9 12	17 00	8 40	7 31	35 00	10 24	46	65 00	11 16	50
10	32	39	10	7 01	10	20	43	28	36 00	27	43	66 00	17	49
20	43	28	20	05	06	40	47	24	37 00	30	40	67 00	18	4 48
30	54	17	30	09	02	18 00	8 50	7 21	38 00	32	38	68 00	19	47
40	4 04	07	40	13	8 58	20	54	17	39 00	35	35	69 00	20	45
50	14	11 57	50	17	54	40	57	14	40 00	10 37	5 32	70 00	11 21	44
7 00	4 24	47	12 00	7 20	8 51	19 00	9 00	7 11	41 00	39	30	71 00	22	43
10	33	38	10	24	47	20	03	08	42 00	41	28	72 00	23	42
20	42	29	20	28	43	40	06	05	43 00	44	25	73 00	24	41
30	51	20	30	31	40	20 00	9 08	7 02	44 00	46	23	74 00	25	40
40	59	12	40	34	37	30	12	6 58	45 00	10 48	21	75 00	11 26	4 39
50	5 07	04	50	38	33	21 00	9 16	6 54	46 00	50	19	76 00	27	38
8 00	5 15	10 56	13 00	7 41	8 30	30	20	50	47 00	52	17	77 00	28	37
10	22	49	10	44	27	22 00	9 24	6 46	48 00	53	16	78 00	29	35
20	29	42	20	47	24	30	27	43	49 00	55	14	79 00	30	34
30	36	35	30	50	21	23 00	9 31	6 39	50 00	10 56	5 12	80 00	11 31	33
40	43	28	40	53	18	30	34	36	51 00	58	10	81 00	32	32
50	49	22	50	56	15	24 00	9 37	6 33	52 00	59	08	82 00	33	31
9 00	5 55	10 16	14 00	7 58	8 13	30	40	30	53 00	11 01	07	83 00	34	4 30
10	6 01	10	10	8 01	10	25 00	9 43	6 27	54 00	03	05	84 00	35	29
20	07	04	20	04	07	30	45	25	55 00	04	04	85 00	11 36	28
30	13	9 58	30	06	05	26 00	9 48	6 23	56 00	05	02	86 00	37	27
40	18	53	40	09	02	27 00	53	17	57 00	06	01	87 00	37	26
50	24	47	50	11	8 00	28 00	9 58	6 12	58 00	08	4 59	88 00	38	25

TABLE III.

Correction for Height of Eye of Observer. To be applied to the corrections from Table II according to the sign given.

Height of Eye		Correction	Height of Eye		Correction	Height of Eye		Correction.	Height of Eye		Correction
Feet	Metres	′ ″	Feet	Metres	′ ″	Feet	Metres	′ ″	Feet	Metres	′ ″
10	3.1	+1 17	21	6.4	−0 06	32	9.8	−1 10	55	16.7	−2 53
11	3.4	+1 08	22	6.7	−0 13	33	10.1	−1 15	60	18.3	−3 12
12	3.7	+1 00	23	7.0	−0 19	34	10.4	−1 20	65	19.8	−3 31
13	4.0	+0 51	24	7.3	−0 25	35	10.7	−1 25	70	21.4	−3 49
14	4.3	+0 43	25	7.6	−0 31	36	11.0	−1 30	75	22.9	−4 06
15	4.6	+0 35	26	7.9	−0 37	37	11.3	−1 35	80	24.4	−4 23
16	4.9	+0 28	27	8.2	−0 43	38	11.6	−1 39	85	25.9	−4 40
17	5.2	+0 21	28	8.5	−0 48	39	11.9	−1 44	90	27.4	−4 55
18	5.5	+0 14	29	8.9	−0 54	40	12.2	−1 49	95	28.9	−5 10
19	5.8	+0 07	30	9.2	−1 00	45	13.7	−2 13	100	30.5	−5 25
20	6.1	0	31	9.5	−1 04	50	15.2	−2 23	105	30.8	−5 40

TABLE IV.

Correction for Sun's Semi-Diameter.

Jan. + 15″	Feb. + 11″	March + 5″	April − 4″	May − 11″	June − 16″
July − 15″	August − 11″	Sept. − 5″	Oct. + 4″	Nov. + 11″	Dec. + 16″

The corrections in Table II for the Altitude of a Star may be used for the Planets also, as the Parallax is so small that it may ordinarily be neglected.

TABLE V.

Altitude — Azimuth Table.

Azimuths	Latitudes										Azimuths
	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	
°	′	′	′	′	′	′	′	′	′	′	°
1	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	0.26	1
2	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	0.52	2
3	0.79	0.79	0.79	0.79	0.78	0.78	0.78	0.78	0.78	0.77	3
4	1.05	1.05	1.05	1.05	1.04	1.04	1.04	1.04	1.04	1.03	4
5	1.31	1.31	1.31	1.31	1.30	1.30	1.30	1.30	1.29	1.29	5
6	1.57	1.57	1.57	1.57	1.56	1.56	1.56	1.56	1.56	1.55	6
7	1.83	1.83	1.83	1.83	1.82	1.82	1.82	1.82	1.81	1.81	7
8	2.09	2.09	2.09	2.09	2.08	2.08	2.08	2.08	2.08	2.07	8
9	2.34	2.34	2.34	2.34	2.34	2.34	2.34	2.33	2.32	2.32	9
10	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.60	2.59	2.58	10
11	2.86	2.86	2.86	2.86	2.85	2.88	2.84	2.84	2.83	2.83	11
12	3.12	3.12	3.12	3.12	3.11	3.11	3.11	3.10	3.09	3.08	12
13	3.43	3.42	3.41	3.40	3.38	3.36	3.35	3.34	3.33	3.33	13
14	3.74	3.72	3.70	3.67	3.64	3.62	3.62	3.61	3.60	3.59	14
15	4.02	3.99	3.96	3.93	3.90	3.87	3.86	3.85	3.84	3.83	15
16	4.30	4.27	4.24	4.20	4.16	4.12	4.11	4.10	4.09	4.08	16
17	4.58	4.55	4.50	4.46	4.41	4.37	4.36	4.35	4.34	4.33	17
18	4.87	4.82	4.77	4.72	4.67	4.62	4.61	4.60	4.59	4.58	18
19	5.17	5.10	5.04	4.98	4.92	4.87	4.86	4.85	4.84	4.83	19
20	5.46	5.39	5.32	5.25	5.18	5.11	5.10	5.09	5.08	5.07	20
21	5.76	5.68	5.60	5.52	5.44	5.36	5.35	5.33	5.32	5.31	21
22	6.06	5.97	5.88	5.79	5.70	5.60	5.59	5.58	5.57	5.55	22
23	6.37	6.27	6.16	6.05	5.95	5.84	5.82	5.80	5.79	5.78	23
24	6.68	6.56	6.44	6.32	6.20	6.08	6.06	6.04	6.03	6.02	24
25	7.00	6.86	6.73	6.62	6.45	6.32	6.30	6.28	6.26	6.25	25
26	7.32	7.17	7.02	6.87	6.71	6.55	6.54	6.53	6.52	6.50	26
27	7.65	7.47	7.30	7.13	6.96	6.79	6.78	6.76	6.74	6.72	27
28	7.97	7.78	7.59	7.40	7.21	7.02	7.01	6.99	6.97	6.95	28
29	...	...	...	7.66	7.46	7.24	7.23	7.22	7.20	7.18	29
30	...	...	...	...	...	7.47	7.46	7.45	7.43	7.41	30
Azimuths	Change of Altitude in One Minute										Azimuths
	Error in the First Reduction Due to an Error of One Minute in the Hour Angle										

TABLE V.

Altitude — Azimuth Table. — *Continued.*

Azimuths	Latitudes										Azimuths
	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	
°	′	′	′	′	′	′	′	′	′	′	°
1	0.26	0.26	0.26	0.26	0.26	0.25	0.25	0.25	0.25	0.25	1
2	0.52	0.52	0.52	0.52	0.51	0.51	0.51	0.50	0.50	0.50	2
3	0.77	0.77	0.77	0.77	0.76	0.76	0.76	0.75	0.75	0.74	3
4	1.03	1.02	1.02	1.02	1.01	1.01	1.01	1.00	0.99	0.99	4
5	1.28	1.28	1.27	1.27	1.26	1.26	1.25	1.24	1.24	1.24	5
6	1.54	1.54	1.53	1.53	1.52	1.51	1.51	1.50	1.49	1.48	6
7	1.80	1.80	1.79	1.78	1.77	1.76	1.75	1.74	1.74	1.73	7
8	2.06	2.05	2.04	2.03	2.02	2.02	2.01	2.00	1.99	1.98	8
9	2.31	2.30	2.29	2.28	2.27	2.27	2.26	2.25	2.23	2.22	9
10	2.57	2.56	2.55	2.54	2.53	2.52	2.50	2.49	2.47	2.46	10
11	2.82	2.81	2.80	2.79	2.78	2.77	2.76	2.75	2.73	2.71	11
12	3.07	3.05	3.04	3.03	3.02	3.01	3.00	2.99	2.97	2.95	12
13	3.32	3.30	3.29	3.28	3.27	3.26	3.25	3.23	3.21	3.19	13
14	3.58	3.56	3.54	3.53	3.52	3.51	3.49	3.47	3.45	3.43	14
15	3.83	3.81	3.79	3.77	3.76	3.75	3.73	3.71	3.69	3.67	15
16	4.07	4.05	4.03	4.01	4.00	3.99	3.97	3.95	3.93	3.91	16
17	4.32	4.30	4.28	4.26	4.25	4.23	4.21	4.19	4.17	4.14	17
18	4.57	4.55	4.53	4.51	4.49	4.48	4.46	4.44	4.41	4.38	18
19	4.81	4.79	4.77	4.75	4.73	4.72	4.70	4.68	4.65	4.62	19
20	5.05	5.03	5.01	4.99	4.97	4.96	4.94	4.91	4.88	4.85	20
21	5.29	5.27	5.25	5.23	5.21	5.19	5.17	5.14	5.11	5.08	21
22	5.53	5.51	5.49	5.47	5.45	5.43	5.40	5.37	5.34	5.31	22
23	5.77	5.75	5.73	5.71	5.69	5.66	5.63	5.60	5.57	5.54	23
24	6.01	5.98	5.95	5.93	5.91	5.89	5.86	5.83	5.80	5.77	24
25	6.24	6.22	6.20	6.17	6.14	6.12	6.09	6.06	6.03	5.99	25
26	6.48	6.45	6.42	6.39	6.37	6.35	6.32	6.29	6.26	6.22	26
27	6.70	6.67	6.64	6.61	6.59	6.57	6.54	6.51	6.48	6.44	27
28	6.93	6.90	6.87	6.84	6.82	6.80	6.77	6.74	6.70	6.66	28
29	7.16	7.13	7.10	7.07	7.04	7.02	6.99	6.95	6.91	6.87	29
30	7.39	7.36	7.33	7.30	7.27	7.25	7.21	7.17	7.13	7.09	30
Azimuths	Change of Altitude in One Minute										Azimuths
	Error in the First Reduction Due to an Error of One Minute in the Hour Angle										

Altitude — Azimuth Table. — *Continued.*

Azimuths	Latitudes										Azimuths
	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	
°	′	′	′	′	′	′	′	′	′	′	°
1	0.25	0.25	0.25	0.24	0.24	0.24	0.24	0.24	0.23	0.23	1
2	0.49	0.49	0.48	0.48	0.47	0.47	0.47	0.46	0.46	0.45	2
3	0.73	0.73	0.72	0.72	0.71	0.71	0.71	0.70	0.70	0.69	3
4	0.98	0.98	0.97	0.96	0.95	0.95	0.94	0.93	0.92	0.91	4
5	1.22	1.21	1.21	1.20	1.19	1.18	1.17	1.16	1.15	1.14	5
6	1.47	1.46	1.45	1.44	1.43	1.42	1.41	1.40	1.39	1.38	6
7	1.71	1.70	1.69	1.68	1.67	1.65	1.64	1.63	1.61	1.59	7
8	1.96	1.95	1.94	1.93	1.91	1.89	1.88	1.86	1.84	1.82	8
9	2.20	2.19	2.18	2.16	2.14	2.12	2.11	2.09	2.07	2.05	9
10	2.45	2.44	2.42	2.40	2.38	2.36	2.34	2.32	2.30	2.28	10
11	2.69	2.67	2.65	2.63	2.61	2.59	2.57	2.55	2.53	2.51	11
12	2.93	2.91	2.89	2.87	2.85	2.83	2.81	2.79	2.76	2.73	12
13	3.17	3.15	3.13	3.11	3.09	3.06	3.04	3.01	2.98	2.95	13
14	3.41	3.39	3.37	3.35	3.33	3.29	3.26	3.23	3.20	3.17	14
15	3.65	3.63	3.61	3.58	3.55	3.52	3.49	3.46	3.43	3.39	15
16	3.89	3.87	3.84	3.81	3.78	3.75	3.72	3.69	3.66	3.62	16
17	4.12	4.09	4.06	4.03	4.00	3.97	3.94	3.91	3.87	3.83	17
18	4.36	4.33	4.30	4.27	4.24	4.20	4.17	4.13	4.09	4.05	18
19	4.59	4.56	4.53	4.49	4.45	4.41	4.38	4.34	4.30	4.26	19
20	4.82	4.78	4.74	4.70	4.66	4.62	4.59	4.56	4.52	4.48	20
21	5.05	5.00	4.95	4.90	4.85	4.85	4.81	4.77	4.73	4.69	21
22	5.28	5.25	5.21	5.17	5.13	5.09	5.05	5.01	4.97	4.92	22
23	5.50	5.47	5.43	5.39	5.35	5.31	5.27	5.22	5.17	5.12	23
24	5.73	5.69	5.65	5.61	5.57	5.53	5.48	5.43	5.38	5.33	24
25	5.95	5.91	5.87	5.83	5.79	5.74	5.69	5.64	5.59	5.54	25
26	6.18	6.14	6.10	6.06	6.01	5.96	5.91	5.86	5.81	5.75	26
27	6.40	6.36	6.32	6.27	6.22	6.17	6.12	6.07	6.01	5.95	27
28	6.62	6.58	6.53	6.48	6.43	6.38	6.33	6.28	6.22	6.16	28
29	6.83	6.79	6.74	6.69	6.64	6.59	6.54	6.48	6.42	6.36	29
30	7.05	7.00	6.95	6.90	6.85	6.80	6.74	6.68	6.62	6.56	30
Azimuths	Change of Altitude in One Minute										Azimuths
	Error in the First Reduction Due to an Error of One Minute in the Hour Angle										

TABLE V.

Altitude — Azimuth Table. — *Continued.*

Azimuths	Latitudes										Azimuths
	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	
°	′	′	′	′	′	′	′	′	′	′	′
1	0.23	0.23	0.23	0.23	0.22	0.22	0.22	0.21	0.21	0.20	1
2	0.45	0.45	0.44	0.44	0.43	0.43	0.42	0.42	0.41	0.41	2
3	0.68	0.68	0.67	0.66	0.65	0.64	0.63	0.62	0.61	0.60	3
4	0.91	0.90	0.89	0.88	0.87	0.86	0.85	0.84	0.83	0.81	4
5	1.13	1.12	1.11	1.10	1.09	1.07	1.05	1.03	1.02	1.01	5
6	1.36	1.35	1.34	1.32	1.30	1.28	1.26	1.24	1.23	1.22	6
7	1.58	1.57	1.56	1.54	1.52	1.50	1.48	1.46	1.44	1.42	7
8	1.81	1.80	1.78	1.76	1.74	1.72	1.70	1.68	1.66	1.63	8
9	2.03	2.01	1.99	1.97	1.95	1.92	1.90	1.88	1.86	1.83	9
10	2.26	2.24	2.21	2.19	2.16	2.13	2.11	2.09	2.06	2.03	10
11	2.48	2.46	2.43	2.40	2.37	2.34	2.31	2.28	2.25	2.22	11
12	2.70	2.67	2.64	2.61	2.58	2.55	2.52	2.49	2.46	2.43	12
13	2.92	2.89	2.86	2.83	2.80	2.76	2.73	2.70	2.67	2.63	13
14	3.14	3.11	3.08	3.05	3.01	2.97	2.94	2.90	2.86	2.82	14
15	3.36	3.33	3.30	3.26	3.22	3.18	3.14	3.10	3.06	3.02	15
16	3.58	3.55	3.51	3.47	3.43	3.39	3.35	3.31	3.27	3.22	16
17	3.79	3.75	3.71	3.67	3.63	3.59	3.55	3.51	3.46	3.41	17
18	4.01	3.97	3.93	3.89	3.85	3.80	3.75	3.70	3.65	3.60	18
19	4.22	4.18	4.14	4.09	4.04	4.00	3.95	3.90	3.85	3.80	19
20	4.44	4.40	4.35	4.30	4.25	4.20	4.15	4.10	4.04	3.98	20
21	4.65	4.60	4.55	4.50	4.45	4.40	4.35	4.29	4.23	4.17	21
22	4.87	4.82	4.77	4.72	4.66	4.60	4.54	4.48	4.42	4.36	22
23	5.07	5.02	4.97	4.92	4.86	4.80	4.74	4.68	4.62	4.55	23
24	5.28	5.23	5.18	5.12	5.06	5.00	4.94	4.88	4.81	4.74	24
25	5.48	5.43	5.38	5.32	5.26	5.20	5.13	5.06	4.99	4.92	25
26	5.69	5.63	5.57	5.51	5.45	5.39	5.31	5.24	5.17	5.10	26
27	5.89	5.83	5.77	5.71	5.65	5.58	5.50	5.42	5.35	5.28	27
28	6.10	6.04	5.98	5.91	5.84	5.77	5.69	5.61	5.53	5.46	28
29	6.30	6.24	6.17	6.10	6.03	5.96	5.88	5.80	5.72	5.64	29
30	6.50	6.43	6.36	6.29	6.22	6.15	6.07	5.99	5.91	5.83	30
Azimuths	Change of Altitude in One Minute										Azimuths
	Error in the First Reduction Due to an Error of One Minute in the Hour Angle										

TABLE V.

Altitude — Azimuth Table. — *Continued.*

Azi-muths	Latitudes										Azi-muths
	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	
°	′	′	′	′	′	′	′	′	′	′	°
1	0.20	0.20	0.20	0.19	0.19	0.19	0.18	0.18	0.18	0.18	1
2	0.40	0.40	0.39	0.39	0.38	0.37	0.36	0.36	0.35	0.35	2
3	0.60	0.59	0.58	0.57	0.56	0.55	0.54	0.53	0.52	0.51	3
4	0.80	0.79	0.78	0.77	0.76	0.74	0.73	0.72	0.71	0.69	4
5	1.00	0.99	0.98	0.96	0.94	0.92	0.91	0.90	0.88	0.86	5
6	1.20	1.19	1.17	1.15	1.13	1.11	1.09	1.07	1.05	1.03	6
7	1.40	1.38	1.36	1.34	1.32	1.29	1.27	1.25	1.23	1.20	7
8	1.60	1.58	1.56	1.54	1.52	1.48	1.46	1.43	1.40	1.37	8
9	1.80	1.78	1.75	1.72	1.69	1.66	1.63	1.60	1.57	1.54	9
10	2.00	1.97	1.94	1.91	1.88	1.84	1.81	1.78	1.75	1.71	10
11	2.19	2.16	2.13	2.10	2.06	2.02	1.99	1.96	1.92	1.88	11
12	2.39	2.36	2.33	2.29	2.25	2.21	2.17	2.13	2.09	2.05	12
13	2.59	2.56	2.52	2.48	2.44	2.40	2.36	2.32	2.27	2.22	13
14	2.78	2.74	2.70	2.66	2.62	2.57	2.53	2.48	2.43	2.38	14
15	2.98	2.94	2.90	2.85	2.80	2.75	2.70	2.65	2.60	2.55	15
16	3.17	3.12	3.07	3.02	2.97	2.92	2.87	2.82	2.77	2.72	16
17	3.36	3.31	3.26	3.21	3.16	3.10	3.05	3.00	2.94	2.88	17
18	3.55	3.50	3.45	3.40	3.34	3.28	3.22	3.16	3.10	3.04	18
19	3.74	3.69	3.64	3.59	3.53	3.46	3.40	3.34	3.28	3.21	19
20	3.93	3.87	3.81	3.75	3.69	3.63	3.57	3.51	3.44	3.37	20
21	4.11	4.05	3.99	3.93	3.87	3.80	3.74	3.67	3.60	3.53	21
22	4.30	4.24	4.18	4.11	4.04	3.97	3.90	3.83	3.76	3.69	22
23	4.48	4.42	4.35	4.28	4.21	4.14	4.07	3.99	3.91	3.83	23
24	4.67	4.60	4.53	4.46	4.39	4.31	4.24	4.16	4.08	4.00	24
25	4.85	4.77	4.70	4.63	4.55	4.48	4.40	4.32	4.24	4.16	25
26	5.04	4.97	4.89	4.81	4.73	4.65	4.57	4.49	4.41	4.32	26
27	5.21	5.14	5.06	4.98	4.90	4.82	4.74	4.65	4.56	4.47	27
28	5.38	5.30	5.22	5.14	5.06	4.98	4.89	4.80	4.71	4.62	28
29	5.56	5.48	5.40	5.32	5.23	5.14	5.05	4.96	4.87	4.78	29
30	5.75	5.66	5.57	5.48	5.39	5.30	5.21	5.12	5.02	4.92	30
Azi-muths	Change of Altitude in One Minute Error in the First Reduction Due to an Error of One Minute in the Hour Angle										Azi-muths

TABLE V.

Altitude — Azimuth Table. — *Continued.*

Azimuths	Latitudes									Azimuths
	50°	51°	52°	53°	54°	55°	56°	57°	58°	
°	′	′	′	′	′	′	′	′	′	°
1	0.17	0.17	0.16	0.16	0.15	0.15	0.15	0.15	0.15	1
2	0.34	0.33	0.33	0.32	0.31	0.30	0.30	0.29	0.28	2
3	0.50	0.49	0.48	0.47	0.46	0.45	0.44	0.43	0.42	3
4	0.67	0.66	0.65	0.64	0.62	0.60	0.59	0.58	0.56	4
5	0.84	0.83	0.81	0.79	0.77	0.75	0.73	0.71	0.69	5
6	1.01	0.99	0.97	0.95	0.93	0.90	0.88	0.86	0.84	6
7	1.17	1.15	1.13	1.11	1.08	1.05	1.03	1.00	0.97	7
8	1.34	1.32	1.29	1.26	1.23	1.20	1.17	1.14	1.11	8
9	1.50	1.47	1.44	1.41	1.38	1.35	1.31	1.28	1.25	9
10	1.67	1.64	1.61	1.57	1.53	1.49	1.46	1.42	1.38	10
11	1.84	1.80	1.76	1.72	1.68	1.64	1.60	1.56	1.52	11
12	2.01	1.97	1.93	1.89	1.84	1.79	1.75	1.71	1.66	12
13	2.17	2.13	2.09	2.04	1.99	1.94	1.89	1.84	1.79	13
14	2.33	2.28	2.23	2.18	2.13	2.08	2.03	1.98	1.93	14
15	2.49	2.44	2.39	2.34	2.29	2.23	2.17	2.12	2.07	15
16	2.66	2.61	2.55	2.49	2.43	2.37	2.31	2.25	2.19	16
17	2.82	2.76	2.70	2.64	2.58	2.52	2.45	2.39	2.33	17
18	2.98	2.92	2.86	2.80	2.73	2.66	2.60	2.53	2.46	18
19	3.14	3.08	3.01	2.94	2.87	2.80	2.73	2.66	2.59	19
20	3.30	3.23	3.16	3.09	3.02	2.94	2.87	2.80	2.73	20
21	3.46	3.39	3.32	3.24	3.16	3.08	3.01	2.93	2.85	21
22	3.62	3.54	3.46	3.38	3.30	3.22	3.14	3.06	2.98	22
23	3.75	3.68	3.60	3.52	3.44	3.36	3.28	3.20	3.11	23
24	3.92	3.84	3.76	3.68	3.59	3.50	3.41	3.32	3.23	24
25	4.07	3.99	3.91	3.82	3.73	3.64	3.54	3.45	3.36	25
26	4.23	4.14	4.05	3.96	3.87	3.77	3.68	3.59	3.49	26
27	4.38	4.29	4.20	4.11	4.01	3.91	3.80	3.70	3.60	27
28	4.53	4.44	4.34	4.24	4.14	4.04	3.94	3.84	3.74	28
29	4.68	4.58	4.48	4.38	4.28	4.17	4.07	3.96	3.85	29
30	4.82	4.72	4.62	4.52	4.41	4.30	4.19	4.08	3.97	30
Azimuths	Change of Altitude in One Minute Error in the First Reduction Due to an Error of One Minute in the Hour Angle									Azimuths

TABLE V.

Altitude — Azimuth Table. — *Continued.*

Azimuths	Latitudes							Azimuths
	59°	60°	61°	62°	63°	64°	65°	
°	′	′	′	′	′	′	′	°
1	0.14	0.13	0.13	0.13	0.12	0.12	0.11	1
2	0.27	0.26	0.26	0.25	0.24	0.23	0.22	2
3	0.41	0.39	0.38	0.37	0.36	0.35	0.33	3
4	0.54	0.52	0.51	0.49	0.47	0.46	0.44	4
5	0.67	0.65	0.63	0.61	0.59	0.57	0.55	5
6	0.81	0.78	0.76	0.74	0.72	0.69	0.66	6
7	0.94	0.91	0.89	0.86	0.83	0.80	0.77	7
8	1.08	1.04	1.01	0.98	0.95	0.92	0.88	8
9	1.21	1.17	1.14	1.11	1.07	1.03	0.99	9
10	1.34	1.30	1.26	1.22	1.18	1.14	1.10	10
11	1.48	1.43	1.39	1.35	1.31	1.26	1.21	11
12	1.61	1.56	1.52	1.47	1.42	1.37	1.32	12
13	1.74	1.69	1.64	1.59	1.54	1.49	1.43	13
14	1.87	1.81	1.76	1.71	1.65	1.59	1.53	14
15	2.01	1.94	1.88	1.82	1.76	1.70	1.64	15
16	2.13	2.07	2.01	1.95	1.89	1.82	1.75	16
17	2.26	2.19	2.13	2.06	1.99	1.92	1.85	17
18	2.39	2.32	2.25	2.18	2.11	2.04	1.96	18
19	2.52	2.44	2.37	2.30	2.22	2.14	2.06	19
20	2.65	2.57	2.49	2.41	2.33	2.25	2.17	20
21	2.77	2.69	2.61	2.53	2.45	2.36	2.27	21
22	2.90	2.81	2.73	2.65	2.56	2.47	2.38	22
23	3.02	2.93	2.84	2.75	2.66	2.57	2.48	23
24	3.14	3.05	2.96	2.87	2.78	2.68	2.58	24
25	3.27	3.17	3.08	2.98	2.88	2.78	2.68	25
26	3.39	3.29	3.19	3.09	2.99	2.89	2.78	26
27	3.50	3.40	3.30	3.20	3.10	2.99	2.88	27
28	3.63	3.52	3.42	3.31	3.20	3.09	2.98	28
29	3.74	3.63	3.52	3.41	3.30	3.19	3.08	29
30	3.86	3.75	3.64	3.53	3.41	3.29	3.17	30
Azimuths	Change of Altitude in One Minute							Azimuths
	Error in the First Reduction Due to an Error of One Minute in the Hour Angle							

Table VI.—Error in the First Reduction Due to an Error in the Latitude Used in the Computation.

Azimuth	Difference between the Assumed Latitude and Latitude by Observation												Azimuth
	Difference between the Assumed Declination and the True Declination												
Position Angle	′ 1	′ 2	′ 3	′ 4	′ 5	′ 6	′ 10	′ 20	′ 30	′ 40	′ 50	′ 60	Position Angle
°	′	′	′	′	′	′	′	′	′	′	′	′	°
5	0.0	0.0	0.0	0.01	0.02	0.02	0.04	0.08	0.11	0.15	0.19	0.23	5
10	0.01	0.03	0.05	0.06	0.08	0.09	0.15	0.30	0.46	0.61	0.76	0.91	10
11	0.02	0.04	0.06	0.07	0.09	0.11	0.18	0.37	0.55	0.73	0.92	1.10	11
12	0.02	0.04	0.07	0.09	0.11	0.13	0.22	0.44	0.66	0.87	1.09	1.31	12
13	0.03	0.05	0.08	0.10	0.13	0.15	0.26	0.51	0.77	1.03	1.28	1.54	13
14	0.03	0.06	0.09	0.12	0.15	0.18	0.30	0.59	0.89	1.19	1.49	1.78	14
15	0.03	0.07	0.10	0.14	0.17	0.20	0.34	0.68	1.02	1.36	1.70	2.04	15
16	0.04	0.08	0.12	0.15	0.19	0.23	0.39	0.77	1.16	1.55	1.94	2.32	16
17	0.04	0.09	0.13	0.17	0.22	0.26	0.44	0.87	1.31	1.75	2.19	2.62	17
18	0.05	0.10	0.15	0.20	0.24	0.29	0.49	0.98	1.47	1.96	2.45	2.94	18
19	0.05	0.11	0.16	0.22	0.27	0.33	0.54	1.09	1.63	2.18	2.72	3.27	19
20	0.06	0.12	0.18	0.24	0.30	0.36	0.60	1.21	1.81	2.41	3.02	3.62	20
21	0.07	0.13	0.20	0.27	0.33	0.40	0.66	1.33	1.99	2.66	3.32	3.99	21
22	0.07	0.15	0.22	0.29	0.36	0.44	0.73	1.46	2.18	2.91	3.64	4.37	22
23	0.08	0.16	0.24	0.32	0.40	0.47	0.80	1.59	2.39	3.18	3.98	4.70	23
24	0.09	0.17	0.26	0.35	0.43	0.52	0.86	1.73	2.59	3.46	4.32	5.19	24
25	0.09	0.19	0.28	0.37	0.47	0.56	0.94	1.87	2.81	3.75	4.68	5.62	25
26	0.10	0.20	0.30	0.40	0.51	0.61	1.01	2.02	3.04	4.05	5.06	6.07	26
27	0.11	0.22	0.33	0.44	0.54	0.65	1.09	2.18	3.27	4.36	5.45	6.54	27
28	0.12	0.23	0.35	0.47	0.59	0.70	1.17	2.34	3.51	4.68	5.85	7.02	28
29	0.13	0.25	0.38	0.50	0.63	0.75	1.25	2.51	3.76	5.02	6.27	7.52	29
30	0.13	0.27	0.40	0.54	0.67	0.80	1.34	2.68	4.02	5.36	6.70	8.04	30
31	0.14	0.29	0.43	0.57	0.71	0.86	1.43	2.86	4.28	5.71	7.14	8.57	31
32	0.15	0.30	0.46	0.61	0.76	0.91	1.52	3.04	4.56	6.08	7.60	9.12	32
33	0.16	0.32	0.48	0.65	0.81	0.97	1.61	3.23	4.84	6.45	8.07	9.68	33
34	0.17	0.34	0.51	0.68	0.85	1.03	1.71	3.42	5.13	6.84	8.55	10.26	34
35	0.18	0.36	0.54	0.72	0.90	1.09	1.81	3.62	5.43	7.23	9.04	10.85	35
36	0.19	0.38	0.57	0.76	0.95	1.14	1.91	3.82	5.73	7.64	9.55	11.46	36
37	0.20	0.40	0.60	0.81	1.01	1.21	2.01	4.03	6.04	8.05	10.07	12.08	37
38	0.21	0.42	0.64	0.85	1.06	1.27	2.12	4.24	6.36	8.48	10.60	12.72	38
39	0.22	0.45	0.67	0.89	1.11	1.34	2.23	4.46	6.69	8.91	11.14	13.37	39
40	0.23	0.47	0.70	0.94	1.17	1.40	2.34	4.68	7.02	9.36	11.70	14.04	40

Table VI also shows the Error in the First Reduction due to an Error in the Declination used in the Computation. Enter with M instead of Z.

Table VII.—Error in the Latitude Due to an Error in the Latitude Used in the Computation.

Azimuth	Difference between Assumed Latitude and Latitude by Observation												Azimuth
	′ 1	′ 2	′ 3	′ 4	′ 5	′ 6	′ 10	′ 20	′ 30	′ 40	′ 50	′ 60	
°	′	′	′	′	′	′	′	′	′	′	′	′	°
5	0.0	0.0	0.0	0.01	0.02	0.03	0.04	0.08	0.11	0.15	0.19	0.23	5
10	0.01	0.03	0.05	0.06	0.08	0.09	0.15	0.30	0.46	0.62	0.77	0.92	10
11	0.02	0.04	0.06	0.07	0.09	0.11	0.19	0.38	0.56	0.75	0.94	1.12	11
12	0.02	0.04	0.07	0.09	0.11	0.13	0.22	0.44	0.67	0.89	1.12	1.34	12
13	0.03	0.05	0.08	0.11	0.13	0.16	0.26	0.52	0.79	1.05	1.32	1.58	13
14	0.03	0.06	0.09	0.12	0.15	0.18	0.31	0.62	0.92	1.22	1.53	1.84	14
15	0.04	0.07	0.11	0.14	0.18	0.21	0.35	0.70	1.06	1.41	1.75	2.12	15
16	0.04	0.08	0.12	0.16	0.20	0.24	0.40	0.80	1.21	1.61	2.02	2.42	16
17	0.05	0.09	0.14	0.18	0.23	0.27	0.45	0.90	1.37	1.83	2.28	2.74	17
18	0.05	0.10	0.15	0.21	0.26	0.31	0.51	1.02	1.54	2.06	2.57	3.08	18
19	0.06	0.11	0.17	0.23	0.29	0.35	0.58	1.16	1.73	2.30	2.88	3.46	19
20	0.06	0.12	0.19	0.26	0.32	0.39	0.64	1.28	1.93	2.57	3.21	3.86	20
21	0.07	0.14	0.21	0.28	0.36	0.43	0.71	1.42	2.13	2.85	3.56	4.26	21
22	0.08	0.15	0.24	0.31	0.39	0.47	0.79	1.58	2.36	3.14	3.93	4.72	22
23	0.09	0.17	0.26	0.35	0.43	0.52	0.86	1.72	2.59	3.45	4.32	5.18	23
24	0.09	0.19	0.28	0.38	0.47	0.57	0.94	1.88	2.84	3.79	4.73	5.68	24
25	0.10	0.20	0.31	0.41	0.52	0.62	1.03	2.06	3.10	4.13	5.17	6.20	25
26	0.11	0.22	0.34	0.45	0.56	0.68	1.13	2.26	3.39	4.51	5.63	6.78	26
27	0.12	0.24	0.37	0.49	0.61	0.73	1.22	2.44	3.67	4.89	6.12	7.34	27
28	0.13	0.27	0.40	0.53	0.66	0.80	1.33	2.66	3.98	5.30	6.63	7.96	28
29	0.14	0.29	0.43	0.57	0.72	0.86	1.43	2.86	4.30	5.73	7.17	8.60	29
30	0.15	0.31	0.46	0.62	0.77	0.93	1.55	3.10	4.64	6.19	7.74	9.28	30
31	0.17	0.33	0.50	0.67	0.83	1.00	1.67	3.33	5.00	6.67	8.33	10.00	31
32	0.18	0.36	0.54	0.72	0.90	1.08	1.79	3.58	5.38	7.17	8.96	10.75	32
33	0.19	0.38	0.58	0.77	0.96	1.15	1.92	3.85	5.77	7.69	9.62	11.54	33
34	0.21	0.41	0.62	0.82	1.03	1.24	2.06	4.12	6.19	8.25	10.31	12.37	34
35	0.22	0.44	0.66	0.88	1.10	1.33	2.20	4.42	6.62	8.83	11.04	13.25	35
36	0.24	0.47	0.71	0.94	1.18	1.42	2.36	4.72	7.08	9.44	11.80	14.16	36
37	0.25	0.50	0.76	1.01	1.26	1.51	2.52	5.04	7.56	10.08	12.60	15.13	37
38	0.27	0.54	0.81	1.07	1.35	1.61	2.69	5.38	8.07	10.76	13.45	16.14	38
39	0.29	0.57	0.86	1.15	1.43	1.73	2.87	5.74	8.60	11.47	14.34	17.21	39
40	0.31	0.61	0.92	1.22	1.53	1.84	3.07	6.13	9.20	12.27	15.34	18.40	40

Table VII also shows the error in the Latitude due to an error in the Declination Enter with position angle *M* instead of Azimuth.

TABLE VIII.

For Converting Arc into Time and Time ino Arc.

°	H. M.	°	H. M.	°	H. M.	°	H. M.	°	H. M.	°	H. M.
′	M. S.	′	M. S.	′	M. S.	′	M. S.	′	M. S.	′	M. S.
″	S. $\frac{1}{60}$	″	S. $\frac{1}{60}$	″	S. $\frac{1}{60}$	″	S. $\frac{1}{60}$	″	S. $\frac{1}{60}$	″	S. $\frac{1}{60}$
1	0 4	31	2 4	61	4 4	91	6 4	121	8 4	151	10 4
2	0 8	32	2 8	62	4 8	92	6 8	122	8 8	152	10 8
3	0 12	33	2 12	63	4 12	93	6 12	123	8 12	153	10 12
4	0 16	34	2 16	64	4 16	94	6 16	124	8 16	154	10 16
5	0 20	35	2 20	65	4 20	95	6 20	125	8 20	155	10 20
6	0 24	36	2 24	66	4 24	96	6 24	126	8 24	156	10 24
7	0 28	37	2 28	67	4 28	97	6 28	127	8 28	157	10 28
8	0 32	38	2 32	68	4 32	98	6 32	128	8 32	158	10 32
9	0 36	39	2 36	69	4 36	99	6 36	129	8 36	159	10 36
10	0 40	40	2 40	70	4 40	100	6 40	130	8 40	160	10 40
11	0 44	41	2 44	71	4 44	101	6 44	131	8 44	161	10 44
12	0 48	42	2 48	72	4 48	102	6 48	132	8 48	162	10 48
13	0 52	43	2 52	73	4 52	103	6 52	133	8 52	163	10 52
14	0 56	44	2 56	74	4 56	104	6 56	134	8 56	164	10 56
15	1 0	45	3 0	75	5 0	105	7 0	135	9 0	165	11 0
16	1 4	46	3 4	76	5 4	106	7 4	136	9 4	166	11 4
17	1 8	47	3 8	77	5 8	107	7 8	137	9 8	167	11 8
18	1 12	48	3 12	78	5 12	108	7 12	138	9 12	168	11 12
19	1 16	49	3 16	79	5 16	109	7 16	139	9 16	169	11 16
20	1 20	50	3 20	80	5 20	110	7 20	140	9 20	170	11 20
21	1 24	51	3 24	81	5 24	111	7 24	141	9 24	171	11 24
22	1 28	52	3 28	82	5 28	112	7 28	142	9 28	172	11 28
23	1 32	53	3 32	83	5 32	113	7 32	143	9 32	173	11 32
24	1 36	54	3 36	84	5 36	114	7 36	144	9 36	174	11 36
25	1 40	55	3 40	85	5 40	115	7 40	145	9 40	175	11 40
26	1 44	56	3 44	86	5 44	116	7 44	146	9 44	176	11 44
27	1 48	57	3 48	87	5 48	117	7 48	147	9 48	177	11 48
28	1 52	58	3 52	88	5 52	118	7 52	148	9 52	178	11 52
29	1 56	59	3 56	89	5 56	119	7 56	149	9 56	179	11 56
30	2 0	60	4 0	90	6 0	120	8 0	150	10 0	180	12 0

For Converting Arc into Time and Time into Arc. — *Continued.*

°	H. M.	°	H. M.	°	H. M.	°	H. M.	°	H. M.	°	H. M.
′	M. S.	′	M. S.	′	M. S.	′	M. S.	′	M. S.	′	M. S.
″	S. $\frac{1}{60}$	″	S. $\frac{1}{60}$	″	S. $\frac{1}{60}$	″	S. $\frac{1}{60}$	″	S. $\frac{1}{60}$	″	S. $\frac{1}{60}$
181	12 4	211	14 4	241	16 4	271	18 4	301	20 4	331	22 4
182	12 8	212	14 8	242	16 8	272	18 8	302	20 8	332	22 8
183	12 12	213	14 12	243	16 12	273	18 12	303	20 12	333	22 12
184	12 16	214	14 16	244	16 16	274	18 16	304	20 16	334	22 16
185	12 20	215	14 20	245	16 20	275	18 20	305	20 20	335	22 20
186	12 24	216	14 24	246	16 24	276	18 24	306	20 24	336	22 24
187	12 28	217	14 28	247	16 28	277	18 28	307	20 28	337	22 28
188	12 32	218	14 32	248	16 32	278	18 32	308	20 32	338	22 32
189	12 36	219	14 36	249	16 36	279	18 36	309	20 36	339	22 36
190	12 40	220	14 40	250	16 40	280	18 40	310	20 40	340	22 40
191	12 44	221	14 44	251	16 44	281	18 44	311	20 44	341	22 44
192	12 48	222	14 48	252	16 48	282	18 48	312	20 48	342	22 48
193	12 52	223	14 52	253	16 52	283	18 52	313	20 52	343	22 52
194	12 56	224	14 56	254	16 56	284	18 56	314	20 56	344	22 56
195	13 0	225	15 0	255	17 0	285	19 0	315	21 0	345	23 0
196	13 4	226	15 4	256	17 4	286	19 4	316	21 4	346	23 4
197	13 8	227	15 8	257	17 8	287	19 8	317	21 8	347	23 8
198	13 12	228	15 12	258	17 12	288	19 12	318	21 12	348	23 12
199	13 16	229	15 16	259	17 16	289	19 16	319	21 16	349	23 16
200	13 20	230	15 20	260	17 20	290	19 20	320	21 20	350	23 20
201	13 24	231	15 24	261	17 24	291	19 24	321	21 24	351	23 24
202	13 28	232	15 28	262	17 28	292	19 28	322	21 28	352	23 28
203	13 32	233	15 32	263	17 32	293	19 32	323	21 32	353	23 32
204	13 36	234	15 36	264	17 36	294	19 36	324	21 36	354	23 36
205	13 40	235	15 40	265	17 40	295	19 40	325	21 40	355	23 40
206	13 44	236	15 44	266	17 44	296	19 44	326	21 44	356	23 44
207	13 48	237	15 48	267	17 48	297	19 48	327	21 48	357	23 48
208	13 52	238	15 52	268	17 52	298	19 52	328	21 52	358	23 52
209	13 56	239	15 56	269	17 56	299	19 56	329	21 56	359	23 56
210	14 0	240	16 0	270	18 0	300	20 0	330	22 0	360	24 0

TABLE IX. — Hour Angles and Altitudes at Prime Vertical Transit.

Lat.	Declination.															
	1°		2°		3°		4°		5°		6°		7°		8°	
	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°
2	4 0	30.0														
3	4 42	19.5	3 13	41.8												
4	5 2	14.5	4 0	30.0	2 46	48.6										
5	5 14	11.5	4 26	23.6	3 33	36.9	2 28	53.2								
6	5 22	9.6	4 42	19.5	4 0	30.0	3 13	41.8	2 15	56.4						
7	5 27	8.2	4 54	16.6	4 19	25.4	3 42	34.9	2 58	45.7	2 4	59.1				
8	5 31	7.2	5 2	14.5	4 32	22.1	4 1	30.1	3 26	38.6	2 46	48.7	1 56	61.1		
9	5 35	6.4	5 9	12.8	4 43	19.5	4 15	26.5	3 46	33.8	3 14	41.9	2 37	51.2	1 50	62.8
10	5 37	5.8	5 14	11.6	4 51	17.3	4 27	23.7	4 1	30.1	3 34	37.0	3 3	44.6	2 29	53.3
11	5 39	5.3	5 19	10.5	4 57	15.9	4 36	21.6	4 13	27.2	3 49	33.1	3 23	39.7	2 55	46.8
12	5 41	4.8	5 22	9.6	5 3	14.6	4 43	19.6	4 23	24.8	4 1	30.2	3 39	35.9	3 14	42.0
13	5 43	4.5	5 25	8.9	5 8	13.4	4 49	18.1	4 31	22.8	4 12	27.7	3 51	32.8	3 30	38.2
14	5 44	4.2	5 28	8.3	5 12	12.5	4 55	16.8	4 38	21.1	4 20	25.6	4 2	30.2	3 43	35.1
15	5 45	3.9	5 30	7.7	5 15	11.7	5 0	15.7	4 44	19.7	4 28	23.8	4 11	28.1	3 53	32.5
16	5 46	3.6	5 32	7.2	5 18	10.9	5 4	14.7	4 49	18.4	4 34	22.3	4 19	26.2	4 3	30.3
17	5 47	3.4	5 34	6.8	5 21	10.3	5 7	13.8	4 53	17.3	4 40	20.9	4 25	24.6	4 10	28.4
18	5 48	3.2	5 35	6.5	5 23	9.7	5 10	13.1	4 57	16.4	4 45	19.8	4 31	23.2	4 17	26.8
19	5 48	3.1	5 37	6.2	5 25	9.2	5 13	12.4	5 1	15.5	4 49	18.7	4 36	22.0	4 24	25.3
20	5 49	2.9	5 38	5.9	5 27	8.8	5 15	11.8	5 4	14.8	4 53	17.8	4 41	20.8	4 30	24.0
21	5 50	2.8	5 39	5.6	5 29	8.4	5 18	11.2	5 7	14.1	4 56	17.0	4 45	19.8	4 35	22.8
22	5 50	2.7	5 40	5.3	5 30	8.0	5 20	10.7	5 10	13.4	5 0	16.2	4 49	19.0	4 39	21.8
23	5 51	2.6	5 41	5.1	5 32	7.7	5 22	10.3	5 12	12.8	5 3	15.5	4 53	18.2	4 43	20.8
24	5 51	2.5	5 42	4.9	5 33	7.4	5 24	9.9	5 15	12.3	5 5	14.9	4 56	17.4	4 46	20.0
25	5 51	2.4	5 43	4.7	5 34	7.1	5 25	9.5	5 17	11.9	5 8	14.3	4 59	16.8	4 50	19.2
26	5 52	2.3	5 44	4.6	5 35	6.8	5 27	9.1	5 19	11.5	5 10	13.8	5 2	16.1	4 53	18.5
27	5 52	2.2	5 44	4.4	5 36	6.6	5 28	8.8	5 20	11.1	5 12	13.3	5 4	15.5	4 56	17.8
28	5 52	2.1	5 45	4.3	5 37	6.4	5 30	8.5	5 22	10.7	5 14	12.8	5 7	15.0	4 59	17.2
29	5 53	2.1	5 45	4.1	5 38	6.2	5 31	8.2	5 24	10.3	5 16	12.4	5 9	14.6	5 1	16.7
30	5 53	2.0	5 46	4.0	5 39	6.0	5 32	8.0	5 25	10.0	5 18	12.1	5 11	14.1	5 4	16.2
31	5 53	2.0	5 47	3.9	5 40	5.8	5 33	7.8	5 27	9.7	5 20	11.7	5 13	13.7	5 6	15.7
32	5 54	1.9	5 47	3.8	5 41	5.7	5 34	7.6	5 28	9.5	5 21	11.4	5 15	13.3	5 8	15.2
33	5 54	1.8	5 48	3.7	5 41	5.5	5 35	7.4	5 29	9.2	5 23	11.1	5 16	12.9	5 10	14.8

OF CALIFORNIA

TABLE IX. — *Continued.*

Lat.	Declination.															
	1°		2°		3°		4°		5°		6°		7°		8°	
	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°
34	5 54	1.8	5 48	3.6	5 42	5.4	5 36	7.2	5 30	9.0	5 24	10.8	5 18	12.6	5 12	14.4
35	5 54	1.8	5 49	3.5	5 43	5.2	5 37	7.0	5 31	8.7	5 25	10.5	5 20	12.3	5 14	14.0
36	5 54	1.7	5 49	3.4	5 43	5.1	5 38	6.8	5 32	8.5	5 27	10.2	5 21	12.0	5 15	13.7
37	5 55	1.7	5 49	3.3	5 44	5.0	5 39	6.7	5 33	8.3	5 28	10.0	5 22	11.7	5 17	13.4
38	5 55	1.6	5 50	3.2	5 45	4.9	5 39	6.5	5 34	8.1	5 29	9.8	5 24	11.4	5 19	13.1
39	5 55	1.6	5 50	3.2	5 45	4.8	5 40	6.4	5 35	8.0	5 30	9.6	5 25	11.2	5 20	12.8
40	5 55	1.5	5 50	3.1	5 46	4.7	5 41	6.2	5 36	7.8	5 31	9.4	5 26	10.9	5 21	12.5
41	5 55	1.5	5 51	3.0	5 46	4.6	5 42	6.1	5 37	7.6	5 32	9.2	5 28	10.7	5 23	12.2
42	5 56	1.5	5 51	3.0	5 47	4.5	5 42	6.0	5 38	7.5	5 33	9.0	5 29	10.5	5 24	12.0
43	5 56	1.5	5 51	2.9	5 47	4.4	5 43	5.9	5 38	7.3	5 34	8.8	5 30	10.3	5 25	11.8
44	5 56	1.4	5 52	2.8	5 48	4.3	5 43	5.8	5 39	7.2	5 35	8.6	5 31	10.1	5 27	11.5
45	5 56	1.4	5 52	2.8	5 48	4.2	5 44	5.7	5 40	7.1	5 36	8.5	5 32	9.9	5 28	11.3
46	5 56	1.4	5 52	2.8	5 48	4.2	5 45	5.6	5 41	7.0	5 37	8.4	5 33	9.7	5 29	11.1
47	5 56	1.4	5 53	2.7	5 49	4.1	5 45	5.5	5 41	6.8	5 37	8.2	5 34	9.6	5 30	11.0
48	5 56	1.3	5 53	2.7	5 49	4.0	5 46	5.4	5 42	6.7	5 38	8.1	5 35	9.4	5 31	10.8
49	5 57	1.3	5 53	2.6	5 50	4.0	5 46	5.3	5 43	6.6	5 39	8.0	5 35	9.3	5 32	10.6
50	5 57	1.3	5 53	2.6	5 50	3.9	5 47	5.2	5 43	6.5	5 40	7.8	5 36	9.1	5 33	10.5
51	5 57	1.3	5 54	2.6	5 50	3.8	5 47	5.1	5 44	6.4	5 40	7.7	5 37	9.0	5 34	10.3
52	5 57	1.3	5 54	2.5	5 51	3.8	5 47	5.1	5 44	6.3	5 41	7.6	5 38	8.9	5 35	10.2
53	5 57	1.3	5 54	2.5	5 51	3.8	5 48	5.0	5 45	6.3	5 42	7.5	5 39	8.8	5 36	10.0
54	5 57	1.2	5 54	2.5	5 51	3.7	5 48	5.0	5 45	6.2	5 42	7.4	5 40	8.6	5 37	9.9
55	5 57	1.2	5 54	2.4	5 52	3.7	5 49	4.9	5 46	6.1	5 43	7.3	5 40	8.5	5 37	9.8
56	5 57	1.2	5 55	2.4	5 52	3.6	5 49	4.8	5 46	6.0	5 44	7.2	5 41	8.4	5 38	9.6
57	5 57	1.2	5 55	2.4	5 52	3.6	5 50	4.8	5 47	6.0	5 45	7.1	5 42	8.3	5 39	9.5
58	5 57	1.2	5 55	2.4	5 52	3.5	5 50	4.7	5 47	5.9	5 45	7.1	5 42	8.3	5 40	9.4
59	5 58	1.2	5 55	2.3	5 53	3.5	5 50	4.7	5 48	5.8	5 46	7.0	5 43	8.2	5 41	9.3
60	5 58	1.1	5 55	2.3	5 53	3.5	5 51	4.6	5 48	5.8	5 46	6.9	5 44	8.1	5 41	9.2
61	5 58	1.1	5 56	2.3	5 53	3.4	5 51	4.6	5 49	5.7	5 47	6.8	5 44	8.0	5 42	9.1
62	5 58	1.1	5 56	2.3	5 54	3.4	5 51	4.5	5 49	5.7	5 47	6.8	5 45	7.9	5 43	9.1
63	5 58	1.1	5 56	2.2	5 54	3.4	5 52	4.5	5 50	5.6	5 48	6.7	5 46	7.8	5 44	9.0
64	5 58	1.1	5 56	2.2	5 54	3.3	5 52	4.4	5 50	5.6	5 48	6.7	5 46	7.8	5 44	8.9
65	5 58	1.1	5 56	2.2	5 54	3.3	5 53	4.4	5 51	5.5	5 49	6.6	5 47	7.7	5 45	8.8

TABLE IX. — *Continued.*

Lat.	Declination.															
	9°		10°		11°		12°		13°		14°		15°		16°	
	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°
10	1 44	64.3														
11	2 22	55.1	1 40	65.5												
12	2 47	48.8	2 16	56.6	1 35	66.6										
13	3 7	44.1	2 41	50.5	2 11	58.0	1 32	67.5								
14	3 22	40.3	3 0	45.9	2 35	52.1	2 6	59.2	1 29	68.5						
15	3 35	37.2	3 16	42.1	2 54	47.5	2 30	53.4	2 2	60.3	1 26	69.2				
16	3 46	34.6	3 28	39.1	3 9	43.8	2 49	49.0	2 26	54.7	1 58	61.4	1 23	69.9		
17	3 55	32.3	3 39	36.4	3 22	40.7	3 4	45.3	2 44	50.3	2 21	55.8	1 55	62.3	1 21	70.5
18	4 3	30.4	3 49	34.2	3 33	38.1	3 17	42.3	2 59	46.7	2 40	51.5	2 18	56.8	1 52	63.1
19	4 10	28.7	3 57	32.2	3 43	35.8	3 28	39.7	3 12	43.7	2 54	48.0	2 36	52.6	2 14	57.8
20	4 17	27.2	4 4	30.5	3 51	33.9	3 38	37.4	3 23	41.1	3 7	45.0	2 50	49.2	2 32	53.7
21	4 23	25.9	4 10	29.0	3 58	32.2	3 46	35.5	3 32	38.8	3 18	42.5	3 3	46.2	2 47	50.3
22	4 28	24.7	4 16	27.6	4 5	30.6	3 53	33.7	3 41	36.9	3 28	40.2	3 14	43.7	2 59	47.4
23	4 32	23.6	4 22	26.4	4 11	29.2	4 0	32.1	3 48	35.1	3 36	38.2	3 23	41.5	3 10	44.9
24	4 37	22.6	4 27	25.3	4 16	28.0	4 6	30.7	3 55	33.6	3 44	36.5	3 32	39.5	3 20	42.7
25	4 41	21.7	4 31	24.3	4 21	26.8	4 12	29.5	4 1	32.1	3 51	34.9	3 40	37.8	3 28	40.7
26	4 44	20.9	4 35	23.3	4 26	25.8	4 17	28.3	4 7	30.8	3 57	33.5	3 47	36.2	3 36	39.0
27	4 48	20.2	4 39	22.5	4 30	24.8	4 21	27.2	4 12	29.7	4 3	32.2	3 54	34.8	3 43	37.4
28	4 51	19.5	4 43	21.7	4 34	24.0	4 26	26.3	4 17	28.6	4 8	31.0	3 59	33.5	3 49	35.9
29	4 54	18.8	4 46	21.0	4 38	23.2	4 30	25.4	4 22	27.6	4 13	29.9	4 4	32.3	3 55	34.6
30	4 56	18.2	4 49	20.3	4 41	22.4	4 34	24.6	4 26	26.7	4 18	28.9	4 9	31.2	4 1	33.4
31	4 59	17.7	4 52	19.7	4 44	21.7	4 37	23.8	4 30	25.9	4 22	28.0	4 14	30.2	4 6	32.3
32	5 1	17.2	4 54	19.1	4 47	21.1	4 40	23.1	4 33	25.1	4 26	27.2	4 18	29.2	4 11	31.3
33	5 4	16.7	4 57	18.6	4 50	20.5	4 44	22.4	4 37	24.4	4 30	26.4	4 22	28.4	4 15	30.4
34	5 6	16.2	4 59	18.1	4 53	19.9	4 47	21.8	4 40	23.7	4 33	25.6	4 26	27.6	4 19	29.5
35	5 8	15.8	5 2	17.6	4 56	19.4	4 49	21.2	4 43	23.1	4 37	24.9	4 30	26.8	4 23	28.7
36	5 10	15.4	5 4	17.2	4 58	18.9	4 52	20.7	4 46	22.5	4 40	24.3	4.33	26.1	4 27	28.0
37	5 11	15.1	5 6	16.8	5 0	18.5	4 54	20.2	4 49	21.9	4 43	23.7	4 37	25.5	4 31	27.3

TABLE IX. — *Continued.*

Lat.	Declination.															
	9°		10°		11°		12°		13°		14°		15°		16°	
	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°
38	5 13	14.7	5 8	16.4	5 2	18.1	4 57	19.7	4 51	21.4	4 46	23.1	4 40	24.9	4 34	26.6
39	5 15	14.4	5 10	16.0	5 4	17.7	4 59	19.3	4 54	20.9	4 48	22.6	4 43	24.3	4 37	26.0
40	5 16	14.1	5 11	15.7	5 6	17.3	5 1	18.9	4 56	20.5	4 51	22.1	4 46	23.7	4 40	25.4
41	5 18	13.8	5 13	15.3	5 8	16.9	5 3	18.5	4 58	20.0	4 53	21.6	4 48	23.2	4 43	24.8
42	5 19	13.5	5 15	15.0	5 10	16.6	5 5	18.1	5 1	19.6	4 56	21.2	4 51	22.7	4 46	24.3
43	5 21	13.3	5 16	14.7	5 12	16.2	5 7	17.7	5 3	19.3	4 58	20.8	4 53	22.3	4 48	23.8
44	5 22	13.0	5 18	14.5	5 14	15.9	5 9	17.4	5 5	18.9	5 0	20.4	4 56	21.9	4 51	23.4
45	5 24	12.8	5 19	14.2	5 15	15.7	5 11	17.1	5 7	18.5	5 2	20.0	4 58	21.5	4 53	22.9
46	5 25	12.6	5 21	14.0	5 17	15.4	5 13	16.8	5 8	18.2	5 4	19.6	5 0	21.1	4 56	22.5
47	5 26	12.3	5 22	13.7	5 18	15.1	5 14	16.5	5 10	17.9	5 6	19.3	5 2	20.7	4 58	22.1
48	5 27	12.1	5 23	13.5	5 20	14.8	5 16	16.2	5 12	17.6	5 8	19.0	5 4	20.4	5 0	21.8
49	5 28	12.0	5 25	13.3	5 21	14.6	5 17	16.0	5 14	17.3	5 10	18.7	5 6	20.1	5 2	21.4
50	5 29	11.8	5 26	13.1	5 22	14.4	5 19	15.7	5 15	17.1	5 12	18.4	5 8	19.7	5 4	21.1
51	5 31	11.6	5 27	12.9	5 24	14.2	5 20	15.5	5 17	16.8	5 13	18.1	5 10	19.4	5 6	20.8
52	5 32	11.4	5 28	12.7	5 25	14.0	5 22	15.3	5 18	16.6	5 15	17.8	5 12	19.2	5 8	20.5
53	5 33	11.3	5 29	12.6	5 26	13.8	5 23	15.1	5 20	16.4	5 17	17.6	5 14	18.9	5 10	20.2
54	5 34	11.1	5 31	12.4	5 28	13.6	5 24	14.9	5 21	16.1	5 18	17.4	5 16	18.7	5 12	19.9
55	5 35	11.0	5 32	12.2	5 29	13.5	5 26	14.7	5 23	15.9	5 20	17.2	5 17	18.4	5 14	19.7
56	5 35	10.8	5 33	12.1	5 30	13.3	5 27	14.5	5 24	15.7	5 21	17.0	5 18	18.2	5 16	19.4
57	5 36	10.7	5 34	11.9	5 31	13.2	5 28	14.3	5 26	15.6	5 23	16.8	5 20	18.0	5 17	19.2
58	5 37	10.6	5 35	11.8	5 32	13.0	5 29	14.2	5 27	15.4	5 24	16.6	5 22	17.8	5 19	19.0
59	5 38	10.5	5 36	11.7	5 33	12.8	5 31	14.0	5 28	15.2	5 26	16.4	5 23	17.6	5 20	18.8
60	5 39	10.4	5 37	11.6	5 34	12.7	5 32	13.8	5 29	15.0	5 27	16.2	5 24	17.4	5 22	18.6
61	5 40	10.3	5 38	11.4	5 35	12.6	5 33	13.7	5 31	15.9	5 28	16.0	5 26	17.2	5 23	18.4
62	5 41	10.2	5 38	11.3	5 36	12.5	5 34	13.6	5 32	14.8	5 30	15.9	5 27	17.0	5 25	18.2
63	5 41	10.1	5 39	11.2	5 37	12.4	5 35	13.5	5 33	14.6	5 31	15.7	5 29	16.8	5 26	18.0
64	5 42	10.0	5 40	11.1	5 38	12.2	5 36	13.4	5 34	14.5	5 32	15.6	5 30	16.7	5 28	17.8
65	5 43	9.9	5 41	11.0	5 39	12.1	5 37	13.3	5 35	14.4	5 33	15.5	5 31	16.6	5 29	17.7

TABLE IX. — *Continued.*

Lat.	Declination.															
	17°		18°		19°		20°		21°		22°		23°		24°	
	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°
18	1 19	72.0														
19	1 50	63.9	1 17	71.6												
20	2 11	58.7	1 47	64.6	1 16	72.1										
21	2 29	54.7	2 9	59.6	1 45	65.3	1 14	72.6								
22	2 43	51.3	2 26	55.6	2 6	60.3	1 43	65.9	1 13	73.1						
23	2 56	48.4	2 40	52.3	2 23	56.4	2 4	61.1	1 41	66.5	1 11	73.5				
24	3 7	46.0	2 53	49.4	2 37	53.2	2 21	57.2	2 2	61.8	1 39	67.1	1 10	73.9		
25	3 16	43.8	3 3	47.0	2 50	50.4	2 35	54.0	2 18	58.0	2 0	62.4	1 38	67.6	1 9	74.3
26	3 25	41.8	3 13	44.8	3 0	48.0	2 47	51.3	2 32	54.8	2 16	58.7	1 58	63.0	1 36	68.1
27	3 33	40.1	3 22	42.9	3 10	45.8	2 58	48.8	2 44	52.1	2 30	55.6	2 14	59.4	1 56	63.6
28	3 40	38.5	3 29	41.2	3 19	43.9	3 7	46.7	2 55	49.8	2 42	52.9	2 28	56.3	2 13	60.0
29	3 47	37.1	3 36	39.6	3 27	42.2	3 16	44.8	3 5	47.7	2 53	50.6	2 40	53.7	2 26	57.0
30	3 53	35.8	3 43	38.2	3 34	40.6	3 24	43.1	3 13	45.8	3 20	48.5	2 51	51.4	2 38	54.4
31	3 58	34.6	3 49	36.9	3 40	39.2	3 31	41.6	3 21	44.1	3 11	46.7	3 0	49.3	2 48	52.1
32	4 3	33.5	3 55	35.7	3 46	37.9	3 37	40.2	3 28	42.6	3 19	45.0	3 9	47.5	2 58	50.1
33	4 8	32.5	4 0	34.6	3 52	36.7	3 43	38.9	3 35	41.1	3 26	43.4	3 17	45.8	3 7	48.3
34	4 12	31.5	4 5	33.5	3 57	35.6	3 49	37.7	3 41	39.8	3 33	42.1	3 24	44.3	3 15	46.7
35	4 16	30.6	4 9	32.6	4 2	34.6	3 55	36.6	3 47	38.7	3 39	40.8	3 31	42.9	3 22	45.2
36	4 20	29.8	4 14	31.7	4 7	33.6	4 0	35.6	3 52	37.7	3 45	39.6	3 37	41.7	3 29	43.8
37	4 24	29.0	4 18	30.9	4 11	32.7	4 4	34.6	3 57	36.6	3 50	38.5	3 43	40.5	3 35	42.5
38	4 28	28.3	4 22	30.1	4 15	31.9	4 9	33.7	4 2	35.6	3 55	37.5	3 49	39.4	3 41	41.4
39	4 31	27.7	4 25	29.4	4 19	31.1	4 13	32.9	4 7	34.7	4 0	36.5	3 54	38.4	3 47	40.3
40	4 35	27.1	4 29	28.7	4 23	30.4	4 17	32.1	4 11	33.8	4 5	35.6	3 58	37.4	3 52	39.2
41	4 38	26.5	4 32	28.1	4 27	29.7	4 21	31.4	4 15	33.1	4 9	34.8	4 3	36.5	3 57	38.3

TABLE IX. — *Continued.*

Lat.	Declination.															
	17°		18°		19°		20°		21°		22°		23°		24°	
	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.
°	h m	°	h m	°	h m	°	h m	°	h m	. °	h m	°	h m	°	h m	°
42	4 41	25.9	4 35	27.5	4 30	29.1	4 25	30.7	4 19	32.4	4 13	34.0	4 7	35.7	4 1	37.4
43	4 43	25.4	4 38	26.9	4 33	28.5	4 28	30.1	4 23	31.7	4 17	33.3	4 12	34.9	4 6	36.6
44	4 46	24.9	4 41	26.4	4 36	27.9	4 31	29.5	4 26	31.1	4 21	32.6	4 16	34.2	4 10	35.8
45	4 49	24.4	4 44	25.9	4 39	27.4	4 35	28.9	4 30	30.4	4 25	32.0	4 20	33.5	4 14	35.1
46	4 51	24.0	4 47	25.4	4 42	26.9	4 38	28.4	4 33	29.8	4 28	31.4	4 23	32.9	4 18	34.4
47	4 54	23.6	4 49	25.0	4 45	26.4	4 41	27.9	4 36	29.3	4 31	30.8	4 27	32.3	4 22	33.8
48	4 56	23.2	4 52	24.6	4 48	25.9	4 43	27.4	4 39	28.8	4 35	30.3	4 30	31.7	4 25	33.2
49	4 58	22.8	4 54	24.2	4 50	25.5	4 46	26.9	4 42	28.3	4 38	29.7	4 33	31.2	4 29	32.6
50	5 1	22.4	4 57	23.8	4 53	25.1	4 49	26.5	4 45	27.9	4 41	29.3	4 37	30.7	4 32	32.1
51	5 3	22.1	4 59	23.4	4 55	24.8	4 51	26.1	4 48	27.5	4 44	28.8	4 40	30.2	4 35	31.6
52	5 5	21.8	5 1	23.1	4 58	24.4	4 54	25.7	4 50	27.0	4 46	28.4	4 43	29.7	4 39	31.1
53	5 7	21.5	5 3	22.8	5 0	24.0	4 56	25.4	4 53	26.6	4 49	28.0	4 45	29.3	4 42	30.7
54	5 9	21.2	5 5	22.5	5 2	23.7	4 59	25.0	4 55	26.3	4 52	27.6	4 48	28.9	4 44	30.2
55	5 11	20.9	5 7	22.2	5 4	23.4	5 1	24.7	4 58	25.9	4 54	27.2	4 51	28.5	4 47	29.8
56	5 12	20.6	5 9	21.9	5 6	23.1	5 3	24.4	5 0	25.6	4 57	26.8	4 53	28.1	4 50	29.4
57	5 14	20.4	5 11	21.6	5 8	22.8	5 5	24.1	5 2	25.3	4 59	26.5	4 56	27.8	4 53	29.0
58	5 16	20.2	5 13	21.4	5 10	22.6	5 7	23.8	5 4	25.0	5 1	26.2	4 58	27.4	4 55	28.7
59	5 18	19.9	5 15	21.1	5 12	22.3	5 9	23.5	5 7	24.7	5 4	25.9	5 1	27.1	4 58	28.3
60	5 19	19.7	5 17	20.9	5 14	22.1	5 11	23.3	5 9	24.4	5 6	25.6	5 3	26.8	5 0	28.0
61	5 21	19.5	5 18	20.7	5 16	21.8	5 13	23.0	5 11	24.2	5 8	25.4	5 6	26.5	5 3	27.7
62	5 23	19.3	5 20	20.5	5 18	21.6	5 15	22.8	5 13	23.9	5 10	25.1	5 8	26.3	5 5	27.4
63	5 24	19.1	5 22	20.3	5 20	21.4	5 17	22.6	5 15	23.7	5 12	24.8	5 10	26.0	5 8	27.2
64	5 26	19.0	5 24	20.1	5 21	21.2	5 19	22.4	5 17	23.5	5 15	24.6	5 12	25.8	5 10	26.9
65	5 27	18.8	5 25	19.9	5 23	21.0	5 21	22.2	5 19	23.3	5 17	24.4	5 14	25.5	5 12	26.7

TABLE IX. — *Continued.*

Lat.	Declination.															
	25°		26°		27°		28°		29°		30°		31°		32°	
	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°
26	1 8	74.6														
27	1 35	68.6	1 7	74.9												
28	1 55	64.2	1 34	69.0	1 6	75.3										
29	2 11	60.6	1 53	64.7	1 33	69.5	1 6	75.5								
30	2 25	57.7	2 9	61.2	1 52	65.2	1 32	69.8	1 5	75.8						
31	2 37	55.1	2 22	58.3	2 8	61.8	1 51	65.7	1 31	70.3	1 4	76.1				
32	2 47	52.9	2 35	55.8	2 21	58.9	2 7	62.4	1 50	66.2	1 30	70.6	1 4	76.4		
33	2 56	50.9	2 46	53.6	2 33	56.5	2 20	59.5	2 6	62.9	1 49	66.6	1 29	71.0	1 3	76.6
34	3 5	49.1	2 55	51.6	2 44	54.3	2 32	57.1	2 19	60.1	2 5	63.4	1 48	67.1	1 28	71.4
35	3 13	47.5	3 3	49.8	2 53	52.3	2 42	54.9	2 31	57.7	2 17	60.7	2 4	63.8	1 47	67.5
36	3 20	46.0	3 11	48.2	3 2	50.6	2 51	53.0	2 41	55.6	2 29	58.3	2 17	61.2	2 3	64.3
37	3 27	44.6	3 19	46.7	3 10	49.0	3 0	51.3	2 51	53.7	2 40	56.2	2 28	58.8	2 16	61.7
38	3 33	43.3	3 26	45.4	3 17	47.5	3 8	49.7	2 59	51.9	2 49	54.3	2 39	56.8	2 28	59.3
39	3 39	42.2	3 32	44.1	3 24	46.2	3 16	48.2	3 7	50.4	2 58	52.6	2 49	54.9	2 38	57.3
40	3 45	41.1	3 38	43.0	3 30	44.9	3 23	46.9	3 15	49.0	3 6	51.1	2 58	53.2	2 47	55.5
41	3 50	40.1	3 43	41.9	3 36	43.8	3 29	45.7	3 22	47.6	3 14	49.6	3 5	51.7	2 56	53.9
42	3 55	39.2	3 49	40.9	3 42	42.7	3 35	44.6	3 28	46.4	3 21	48.3	3 13	50.3	3 4	52.4
43	4 0	38.3	3 54	40.0	3 48	41.7	3 41	43.5	3 34	45.3	3 27	47.1	3 20	49.0	3 12	51.0
44	4 4	37.5	3 59	39.1	3 53	40.8	3 46	42.5	3 40	44.3	3 33	46.0	3 26	47.8	3 19	49.7
45	4 9	36.7	4 3	38.3	3 57	39.9	3 51	41.6	3 45	43.3	3 39	45.0	3 32	46.7	3 25	48.5
46	4 13	36.0	4 8	37.5	4 2	39.1	3 56	40.7	3 50	42.4	3 44	44.0	3 38	45.7	3 31	47.4
47	4 17	35.3	4 12	36.8	4 7	38.4	4 1	39.9	3 55	41.5	3 49	43.1	3 44	44.7	3 37	46.4
48	4 21	34.7	4 16	36.1	4 11	37.7	4 6	39.1	4 0	40.7	3 54	42.3	3 49	43.8	3 43	45.5
49	4 24	34.1	4 20	35.5	4 15	37.0	4 10	38.4	4 5	40.0	3 59	41.5	3 54	43.0	3 48	44.6
50	4 28	33.5	4 23	34.9	4 19	36.3	4 14	37.8	4 9	39.3	4 4	40.7	3 59	42.2	3 53	43.7

TABLE IX.— *Continued.*

Lat.	Declination.															
	25°		26°		27°		28°		29°		30°		31°		32°	
	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°
51	4 31	32.9	4 27	34.3	4 23	35.7	4 18	37.2	4 13	38.6	4 8	40.0	4 4	41.5	3 58	43.0
52	4 35	32.4	4 30	33.8	4 26	35.1	4 22	36.6	4 17	38.0	4 13	39.4	4 8	40.8	4 3	42.3
53	4 38	31.9	4 34	33.3	4 30	34.6	4 26	36.0	4 21	37.4	4 17	38.8	4 12	40.1	4 8	41.6
54	4 41	31.5	4 37	32.8	4 34	34.1	4 30	35.5	4 25	36.8	4 21	38.2	4 16	39.5	4 12	40.9
55	4 44	31.1	4 40	32.3	4 37	33.6	4 33	35.0	4 29	36.3	4 25	37.6	4 20	38.9	4 16	40.3
56	4 47	30.7	4 43	31.9	4 40	33.2	4 36	34.5	4 32	35.8	4 28	37.1	4 24	38.3	4 20	39.7
57	4 49	30.3	4 46	31.5	4 43	32.8	4 39	34.0	4 36	35.3	4 32	36.6	4 28	37.8	4 24	39.2
58	4 52	29.9	4 49	31.1	4 46	32.4	4 42	33.6	4 39	34.8	4 35	36.1	4 32	37.4	4 28	38.7
59	4 55	29.5	4 52	30.7	4 49	32.0	4 45	33.2	4 42	34.4	4 39	35.7	4 35	36.9	4 32	38.2
60	4 58	29.2	4 55	30.4	4 52	31.6	4 48	32.8	4 45	34.0	4 42	35.3	4 39	36.5	4 35	37.7
61	5 0	28.9	4 57	30.1	4 54	31.3	4 51	32.5	4 48	33.7	4 45	34.8	4 42	36.1	4 39	37.3
62	5 3	28.6	5 0	29.7	4 57	30.9	4 54	32.1	4 51	33.3	4 48	34.5	4 45	35.7	4 42	36.8
63	5 5	28.3	5 2	29.5	5 0	30.5	4 57	31.8	4 54	33.0	4 52	34.1	4 48	35.3	4 46	36.5
64	5 7	28.0	5 5	29.2	5 2	30.3	5 0	31.5	4 57	32.6	4 55	33.8	4 50	35.0	4 49	36.1
65	5 10	27.8	5 7	28.9	5 5	30.1	5 3	31.2	5 0	32.3	4 58	33.5	4 53	34.6	4 52	35.8
	33°		34°		35°		36°		37°		38°		39°		40°	
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°
34	1 3	76.9														
35	1 28	71.7	1 2	77.1												
36	1 47	67.9	0 27	72.0	1 2	77.4										
37	2 2	64.8	1 46	68.3	1 27	72.4	1 1	77.6								
38	2 15	62.2	2 1	65.3	1 45	68.7	1 26	72.7	1 1	77.8						
39	2 27	59.9	2 14	62.7	2 1	65.7	1 45	69.1	1 26	73.0	1 1	78.0				
40	2 37	57.9	2 26	60.4	2 14	63.2	2 0	66.1	1 44	69.4	1 26	73.3	1 1	78.2		

TABLE IX. — *Continued.*

Lat.	Declination.															
	33°		34°		35°		36°		37°		38°		39°		40°	
	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°
41	2 47	56.1	2 36	58.5	2 25	61.0	2 13	63.6	2 0	66.5	1 44	69.8	1 25	73.6	1 1	78.5
42	2 55	54.5	2 46	56.7	2 36	59.0	2 25	61.4	2 13	64.1	1 59	66.9	1 44	70.1	1 25	73.9
43	3 3	53.0	2 55	55.1	2 45	57.2	2 35	59.5	2 24	61.9	2 12	64.5	1 59	67.3	1 43	70.5
44	3 11	51.6	3 3	53.6	2 54	55.7	2 45	57.8	2 35	60.0	2 24	62.4	2 12	64.9	1 59	67.7
45	3 18	50.4	3 10	52.3	3 2	54.2	2 54	56.2	2 44	58.3	2 34	60.5	2 24	62.8	2 12	65.4
46	3 25	49.2	3 17	51.0	3 10	52.8	3 2	54.8	2 53	56.8	2 44	58.8	2 34	61.0	2 23	63.3
47	3 31	48.1	3 24	49.8	3 17	51.6	3 9	53.5	3 1	55.4	2 53	57.3	2 44	59.3	2 34	61.5
48	3 37	47.1	3 30	48.8	3 24	50.5	3 16	52.3	3 9	54.1	3 1	55.9	2 53	57.8	2 44	59.9
49	3 43	46.2	3 36	47.8	3 30	49.5	3 23	51.1	3 16	52.8	3 9	54.7	3 1	56.5	2 53	58.4
50	3 48	45.3	3 42	46.8	3 36	48.5	3 30	50.1	3 23	51.7	3 16	53.5	3 9	55.3	3 1	57.0
51	3 53	44.5	3 48	46.0	3 42	47.6	3 36	49.1	3 30	50.7	3 23	52.4	3 16	54.1	3 9	55.8
52	3 58	43.7	3 53	45.2	3 47	46.7	3 42	48.2	3 36	49.8	3 30	51.4	3 23	53.0	3 16	54.7
53	4 2	43.0	3 58	44.4	3 53	45.9	3 47	47.4	3 42	48.9	3 36	50.4	3 30	52.0	3 23	53.6
54	4 7	42.3	4 3	43.7	3 58	45.1	3 53	46.6	3 47	48.1	3 42	49.5	3 36	51.1	3 30	52.6
55	4 12	41.7	4 7	43.0	4 3	44.4	3 58	45.8	3 53	47.3	3 47	48.7	3 42	50.2	3 36	51.7
56	4 16	41.1	4 12	42.4	4 7	43.8	4 3	45.1	3 58	46.5	3 53	47.9	3 48	49.4	3 42	50.8
57	4 20	40.5	4 16	41.8	4 12	43.1	4 7	44.5	4 3	45.8	3 58	47.2	3 53	48.6	3 48	50.0
58	4 24	40.0	4 20	41.2	4 16	42.5	4 12	43.9	4 8	45.2	4 3	46.5	3 58	47.9	3 53	49.3
59	4 28	39.5	4 24	40.7	4 20	42.0	4 16	43.3	4 12	44.6	4 8	45.9	4 3	47.2	3 59	48.6
60	4 32	39.0	4 28	40.2	4 25	41.5	4 21	42.7	4 17	44.0	4 13	45.3	4 8	46.6	4 4	47.9
61	4 36	38.5	4 32	39.7	4 29	41.0	4 25	42.2	4 21	43.5	4 17	44.7	4 13	46.0	4 9	47.3
62	4 39	38.2	4 36	39.3	4 33	40.5	4 29	41.7	4 26	42.9	4 22	44.2	4 18	45.5	4 14	46.7
63	4 43	37.7	4 40	38.8	4 36	40.1	4 33	41.3	4 30	42.5	4 26	43.7	4 23	44.9	4 19	46.2
64	4 47	37.3	4 43	38.5	4 40	39.6	4 37	40.8	4 34	42.0	4 30	43.2	4 27	44.4	4 23	45.7
65	4 49	36.9	4 47	38.1	4 44	39.3	4 41	40.4	4 38	41.6	4 38	42.8	4 31	44.0	4 28	45.2

TABLE IX.—*Continued.*

Lat.	Declination.															
	41°		42°		43°		44°		45°		46°		47°		48°	
	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.	H. A.	Alt.
°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°	h m	°
42	1 0	78.6														
43	1 25	74.1	1 0	78.8												
44	1 43	70.8	1 25	74.4	1 0	79.0										
45	1 58	68.1	1 43	71.1	1 25	74.7	1 0	79.2								
46	2 12	65.8	1 58	68.5	1 43	71.5	1 25	74.9	1 0	79.4						
47	2 23	63.8	2 12	66.2	1 58	68.8	1 43	71.8	1 25	75.2	1 0	79.6				
48	2 34	62.0	2 23	64.2	2 12	66.6	1 58	69.2	1 43	72.1	1 25	75.5	1 0	79.8		
49	2 44	60.4	2 34	62.4	2 23	64.6	2 12	67.0	1 58	69.5	1 43	72.4	1 25	75.7	1 0	79.9
50	2 53	58.9	2 44	60.9	2 34	62.9	2 23	65.1	2 12	67.4	1 59	69.9	1 43	72.7	1 25	75.9
51	3 1	57.6	2 53	59.4	2 44	61.3	2 34	63.4	2 24	65.5	2 12	67.8	1 59	70.2	1 44	73.0
52	3 9	56.4	3 1	58.1	2 53	59.9	2 44	61.8	2 34	63.8	2 24	65.9	2 12	68.1	2 59	70.6
53	3 16	55.2	3 9	56.9	3 1	58.6	2 53	60.4	2 44	62.3	2 35	64.2	2 24	66.3	2 13	68.5
54	3 23	54.2	3 17	55.8	3 9	57.5	3 2	59.2	2 54	60.9	2 45	62.7	2 35	64.7	2 25	66.7
55	3 30	53.2	3 24	54.8	3 17	56.4	3 10	58.0	3 2	59.7	2 54	61.4	2 45	63.2	2 36	65.1
56	3 36	52.3	3 30	53.8	3 24	55.3	3 18	56.9	3 10	58.5	3 3	60.2	2 54	61.9	2 46	63.7
57	3 42	51.5	3 37	52.9	3 31	54.4	3 25	55.9	3 18	57.5	3 11	59.1	3 3	60.7	2 55	62.4
58	3 48	50.7	3 43	52.1	3 37	53.5	3 32	55.0	3 25	56.5	3 19	58.0	3 12	59.6	3 4	61.2
59	3 54	49.9	3 49	51.3	3 44	52.7	3 38	54.1	3 32	55.6	3 26	57.0	3 20	58.6	3 13	60.1
60	3 59	49.2	3 55	50.6	3 50	51.9	3 44	53.3	3 39	54.7	3 33	56.2	3 27	57.6	3 21	59.1
61	4 5	48.6	4 0	49.9	3 55	51.2	3 51	52.6	3 45	53.9	3 40	55.3	3 34	56.1	3 28	58.2
62	4 10	48.0	4 6	49.3	4 1	50.6	3 56	51.8	3 52	53.2	3 46	54.5	3 41	55.9	3 35	57.3
63	4 15	47.4	4 11	48.7	4 7	49.9	4 2	51.2	3 57	52.5	3 53	53.8	3 48	55.2	3 42	56.5
64	4 20	46.9	4 16	48.1	4 12	49.3	4 8	50.6	4 3	51.9	3 59	53.2	3 54	54.5	3 49	55.8
65	4 24	46.4	4 21	47.6	4 17	48.8	4 13	50.0	4 9	51.3	4 5	52.5	4 00	53.8	3 55	55.1

Latitude 0° Declination North or South.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	5 59	4 59	4 16	3 43	3 18	2 59	2 42	4
8	...	...	...	...	...	23 57	19 55	17 03	14 54	13 14	11 53	10 46	8
12	...	...	...	...	...	53 52	44 50	38 23	33 32	29 46	26 44	24 14	12
16	...	...	...	...	...	...	...	...	59 36	52 54	47 32	43 06	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	...	22.44	18.68	15.99	13.97	12.40	11.14	10.10	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	... ...	1.351 02	1.271 38	1.203 85	1.145 20	1.093 42	1.046 89	1.004 32	Log.
Limit	0	1	3	5	7	8	9	10	11	12	13	14	Minutes
Meridian.	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 28	2 16	2 06	1 57	1 50	1 42	1 37	1 31	1 26	1 22	1 18	1 14	4
8	9 52	9 04	8 24	7 49	7 18	6 51	6 27	6 05	5 45	5 27	5 11	4 56	8
12	22 11	20 24	18 55	17 35	16 26	15 25	14 30	13 41	12 56	12 17	11 40	11 06	12
16	39 25	36 16	33 37	31 17	29 14	27 23	25 46	24 19	23 00	21 51	20 44	19 46	16
20	...	56 40	52 32	48 52	45 40	42 48	40 16	38 00	35 56	34 08	32 24	30 52	20
24	...	...	...	...	65 46	61 38	57 59	54 43	51 45	49 10	46 40	44 27	24
28	...	...	...	...	...	83 54	78 55	74 29	70 26	66 54	63 30	60 30	28
32	...	...	...	...	...	...	...	...	...	...	82 56	79 01	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	9.24	8.50	7.88	7.33	6.85	6.42	6.04	5.70	5.39	5.12	4.86	4.63	$\triangle_1$h
Log.	0.965 67	0.929 42	0.896 53	0.865 10	0.835 69	0.807 54	0.781 04	0.755 87	0.731 59	0.709 27	0.686 64	0.665 58	Log.
Limit	15	16	17	18	19	20	21	22	24	24	25	26	Minutes
Meridian	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	Altitudes

Latitude 0° Declination North or South.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 10	1 07	1 04	1 02	0 59	0 57	0 54	0 52	0 51	0 48	0 46	0 45	4
8	4 43	4 30	4 18	4 06	3 56	3 47	3 38	3 30	3 21	3 13	3 06	2 59	8
12	10 35	10 06	9 40	9 14	8 51	8 30	8 10	7 51	7 32	7 15	6 59	6 43	12
16	18 49	17 58	17 12	16 26	15 45	15 06	14 30	13 57	13 24	12 53	12 25	11 57	16
20	29 24	28 04	26 52	25 40	24 36	23 36	22 40	21 48	20 56	20 08	19 24	18 40	20
24	42 20	40 25	38 41	36 58	35 26	33 59	32 38	31 23	30 09	29 00	27 56	26 53	24
28	57 38	55 01	52 40	50 18	48 13	46 15	44 26	42 44	41 01	39 28	38 02	36 35	28
32	75 16	71 51	68 47	65 42	62 58	60 25	58 02	55 49	53 35	51 32	49 40	47 47	32
36	...	...	...	...	79 43	76 28	73 26	70 38	67 50	65 14	62 51	60 29	36
40	...	...	...	...	...	...	90 40	87 12	83 44	80 32	77 36	74 40	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	4.41	4.21	4.03	3.85	3.69	3.54	3.40	3.27	3.14	3.02	2.91	2.80	$\triangle_1$h
Log.	0.644 44	0.624 28	0.605 31	0.585 46	0.567 03	0.549 00	0.531 48	0.514 55	0.496 93	0.480 01	0.463 89	0.447 16	Log.
Limit	27	28	29	30	31	32	33	33	34	35	36	37	Minutes
Meridian	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	Altitudes

DECLINATIONS.

Hour Angles	36	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 42	0 40	0 38	0 38	0 36	0 35	0 34	0 32	0 31	0 30	0 29	4
8	2 53	2 47	2 41	2 35	2 30	2 25	2 19	2 15	2 10	2 05	2 01	1 57	8
12	6 29	6 15	6 01	5 49	5 37	5 26	5 14	5 03	4 52	4 43	4 34	4 23	12
16	11 31	11 09	10 43	10 19	9 59	9 38	9 18	9 01	8 40	8 21	8 06	7 49	16
20	18 00	17 24	16 44	16 08	15 36	15 04	14 32	14 04	13 32	13 04	12 40	12 12	20
24	25 55	25 04	24 06	23 14	22 28	21 42	20 56	20 16	19 29	18 49	18 14	17 34	24
28	35 17	34 06	32 48	31 38	30 34	29 32	28 29	27 34	26 32	25 37	24 50	23 55	28
32	46 05	44 32	42 50	41 18	39 56	38 34	37 12	36 00	34 39	33 27	32 26	31 13	32
36	58 19	56 23	54 13	52 16	50 33	48 49	47 06	45 35	43 51	42 20	41 02	39 32	36
40	72 00	69 36	66 56	64 32	62 24	60 16	58 08	56 16	54 08	52 16	50 40	48 48	40
44	87 07	84 13	80 59	78 05	75 30	72 55	70 21	68 05	65 30	63 14	61 18	59 03	44
48	...	...	96 23	92 56	89 51	86 47	83 42	81 01	77 57	75 16	72 58	70 16	48
52	...	...	...	...	105 27	101 51	98 14	95 05	91 29	88 20	85 38	82 28	52
56	...	...	...	...	...	...	...	...	106 06	102 26	99 18	95 39	56
60	...	...	...	...	...	...	...	...	...	...	114 00	109 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.70	2.61	2.51	2.42	2.34	2.26	2.18	2.11	2.03	1.96	1.90	1.83	$\triangle_1$h
Log.	0.431 36	0.416 64	0.399 67	0.383 82	0.369 22	0.354 11	0.338 46	0.324 28	0.307 50	0.292 26	0.278 75	0.262 45	Log.
Limit	38	39	40	41	42	43	44	45	46	46	47	48	Minutes
Meridian	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 27	0 27	0 25	0 24	0 23	0 22	0 22	0 21	0 20	0 19	0 19	4
8	1 54	1 50	1 45	1 42	1 38	1 35	1 32	1 28	1 24	1·22	1 19	1 15	8
12	4 16	4 06	3 57	3 49	3 40	3 34	3 24	3 17	3 10	3 05	2 57	2 50	12
16	7 33	7 18	7 03	6 47	6 32	6 18	6 06	5 51	5 38	5 27	5 15	5 02	16
20	11 48	11 24	11 00	10 36	10 12	9 52	9 32	9 08	8 48	8 32	8 12	7 52	20
24	16 59	16 25	15 51	15 16	14 41	14 12	13 43	13 09	12 41	12 17	11 48	11 20	24
28	23 08	22 21	21 33	20 47	20 00	19 21	18 42	17 54	17 15	16 44	16 05	15 25	28
32	30 13	29 11	28 09	27 08	26 07	25 16	24 25	23 23	22 31	21 51	21 00	20 08	32
36	38 14	36 56	35 39	34 21	33 03	31 58	30 53	29 36	28 31	27 39	26 34	25 30	36
40	47 12	45 36	44 00	42 24	40 48	39 28	38 08	36 32	35 12	34 08	32 48	31 28	40
44	57 07	55 10	53 15	51 18	49 22	47 45	46 08	44 13	42 36	41 18	39 41	38 05	44
48	67 56	65 38	63 21	61 03	58 45	56 50	54 55	52 36	50 41	49 09	47 14	45 18	48
52	79 46	77 04	74 21	71 39	68 57	66 42	64 27	61 44	59 29	57 41	55 26	53 10	52
56	92 31	89 22	86 15	83 06	79 58	77 21	74 44	71 37	69 00	66 54	64 17	61 41	56
60	106 12	102 36	99 00	95 24	91 48	88 48	85 48	82 12	79 12	76 48	73 48	70 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.77	1.71	1.65	1.59	1.53	1.48	1.43	1.37	1.32	1.28	1.23	1.18	$\triangle_1 h$
Log.	0.247 97	0.233 00	0.217 48	0.201 40	0.184 69	0.170 26	0.155 34	0.136 72	0.120 57	1.107 21	0.089 91	0.071 88	Log.
Limit	49	50	51	53	54	56	57	58	59	60	62	64	Minutes
Meridian	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 17	0 17	0 16	0 15	0 14	0 14	0 13	0 12	0 12	0 11	0 11	4
8	1 12	1 10	1 07	1 04	1 01	0 58	0 55	0 53	0 51	0 48	0 45	0 42	8
12	2 42	2 37	2 30	2 24	2 19	2 11	2 05	1 59	1 54	1 48	1 42	1 36	12
16	4 50	4 39	4 26	4 16	4 05	3 53	3 43	3 33	3 22	3 12	3 02	2 52	16
20	7 32	7 16	6 56	6 40	6 24	6 04	5 48	5 32	5 16	5 00	4 44	4 28	20
24	10 51	10 28	9 59	9 36	9 13	8 44	8 21	7 58	7 35	7 12	6 49	6 26	24
28	14 46	14 15	13 35	13 04	12 33	11 54	11 22	10 51	10 20	9 48	9 17	8 45	28
32	19 17	18 36	17 45	17 04	16 23	15 32	14 51	14 10	13 29	12 48	12 07	11 26	32
36	24 25	23 33	22 28	21 36	20 44	19 39	18 48	17 56	17 04	16 12	15 20	14 29	36
40	30 08	29 04	27 44	26 40	25 36	24 16	23 12	22 08	21 04	20 00	18 56	17 52	40
44	36 28	35 10	33 33	32 16	30 58	29 21	28 05	26 47	25 29	24 12	22 54	21 38	44
48	43 23	41 51	39 56	38 24	36 52	34 57	33 24	31 52	30 18	28 46	27 14	25 43	48
52	50 55	49 07	46 52	45 04	43 16	41 01	39 12	37 24	35 36	33 48	32 00	30 11	52
56	59 04	56 58	54 21	52 16	50 10	47 33	45 29	43 23	41 17	39 12	37 06	35 02	56
60	67 48	65 24	62 24	60 00	57 36	54 36	52 12	49 48	47 24	45 00	42 36	40 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.13	1.09	1.04	1.00	0.96	0.91	0.87	0.83	0.79	0.75	0.71	0.67	$\triangle_1 h$
Log.	0.053 08	0.037 43	0.017 03	0.00	9.982 27	9.959 04	9.939 52	9.919 08	9.897 63	9.875 06	9.851 26	9.826 07	Log.
Limit	66	68	70	72	74	77	79	81	83	85	87	89	Minutes
Meridian	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	Altitudes

Latitude 1° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	5 58	4 59	4 15	3 43	3 18	2 58	4
8	...	...	...	...	...	...	23 54	19 53	17 00	14 51	13 11	11 50	8
12	...	...	...	...	...	...	...	...	38 17	33 26	29 40	26 38	12
16	...	...	...	...	...	...	...	...	...	59 26	52 44	47 22	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	22.40	18.64	15.95	13.93	12.36	11.10	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	1.350 25	1.270 45	1.202 76	1.143 95	1.092 02	1.045 32	Log.
Limit	2	0	1	3	5	7	8	9	10	11	12	13	Minutes
Meridian	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 41	2 27	2 15	2 06	1 56	1 49	1 42	1 36	1 31	1 36	1 21	1 17	4
8	10 44	9 49	9 03	8 22	7 47	7 16	6 49	6 25	6 03	5 42	5 25	5 08	8
12	24 09	22 05	20 20	18 49	17 30	16 20	15 20	14 25	13 36	12 52	12 12	11 34	12
16	42 55	39 15	36 08	33 27	31 06	29 04	27 16	25 39	24 12	22 52	21 40	20 34	16
20	...	...	56 28	52 16	48 36	45 24	42 36	40 04	37 48	35 44	33 52	32 08	20
24	...	...	...	...	...	65 23	61 21	57 42	54 26	51 28	48 46	46 17	24
28	...	...	...	...	...	...	83 31	78 32	74 05	70 02	66 23	62 59	28
32	...	...	...	...	...	...	...	...	...	...	...	82 15	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	10.06	9.20	8.47	7.84	7.29	6.81	6.39	6.01	5.67	5.36	5.08	4.82	$\triangle_1 h$
Log.	1.002 60	0.963 79	0.927 88	0.894 32	0.862 73	0.833 15	0.805 50	0.778 87	0.753 58	0.729 16	0.705 86	0.683 05	Log.
Limit	14	15	16	17	18	19	20	21	23	24	25	26	Minutes
Meridian	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 13	1 10	1 07	1 03	1 01	0 59	0 56	0 54	0 51	0 50	0 47	0 46	4
8	4 54	4 40	4 27	4 15	4 05	3 54	3 45	3 36	3 27	3 19	3 11	3 04	8
12	11 01	10 29	10 02	9 35	9 10	8 47	8 25	8 05	7 45	7 27	7 11	6 55	12
16	19 35	18 39	17 50	17 01	16 18	15 37	14 59	14 23	13 47	13 17	12 45	12 17	16
20	30 36	29 08	27 52	26 36	25 28	24 24	23 24	22 28	21 32	20 44	19 56	19 12	20
24	44 04	41 57	40 08	38 18	36 41	35 09	33 42	32 21	31 00	29 52	28 42	27 39	24
28	59 59	57 06	54 37	52 09	49 55	47 49	45 52	44 02	42 13	40 38	39 05	37 38	28
32	78 20	74 34	71 20	68 06	65 11	62 27	59 54	57 31	55 08	53 04	51 02	49 09	32
36	...	...	...	...	...	79 04	75 49	72 48	69 46	67 11	64 35	62 13	36
40	...	...	...	...	...	...	...	89 52	86 08	82 56	79 44	76 48	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.59	4.37	4.18	3.99	3.82	3.66	3.51	3.37	3.23	3.11	2.99	2.88	$\triangle_1 h$
Log.	0.661 81	0.640 48	0.621 18	0.600 97	0.582 06	0.563 48	0.545 31	0.527 63	0.509 20	0.492 76	0.475 67	0.459 39	Log.
Limit	26	27	28	29	30	31	32	33	34	35	36	36	Minutes
Meridian	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 44	0 43	0 41	0 39	0 38	0 37	0 35	0 35	0 33	0 32	0 30	0 30	4
8	2 58	2 51	2 45	2 39	2 33	2 28	2 22	2 17	2 13	2 08	2 03	1 59	8
12	6 39	6 24	6 10	5 58	5 44	5 32	5 20	5 09	4 58	4 48	4 38	4 28	12
16	11 49	11 24	10 58	10 34	10 12	9 52	9 28	9 11	8 50	8 32	8 14	7 56	16
20	18 28	17 48	17 08	16 32	15 56	15 24	14 48	14 20	13 48	13 20	12 52	12 24	20
24	26 35	25 38	24 40	23 48	22 57	22 11	21 19	20 39	19 52	19 12	18 31	17 52	24
28	36 12	34 53	33 35	32 25	31 14	30 11	29 01	28 05	27 03	26 08	25 14	24 18	28
32	47 17	45 34	43 52	42 20	40 47	39 25	37 53	36 41	35 20	34 08	32 57	31 44	32
36	59 50	57 41	55 31	53 34	51 38	49 54	47 57	46 27	44 43	43 12	41 41	40 11	36
40	73 52	71 12	68 32	66 08	63 44	61 36	59 12	57 20	55 12	53 20	51 28	49 36	40
44	...	86 10	82 56	80 01	77 07	74 32	71 38	69 23	66 48	64 32	62 16	60 01	44
48	...	...	...	95 14	91 46	88 42	85 15	82 33	79 29	76 48	74 07	71 25	48
52	...	...	...	...	107 42	104 06	100 03	96 53	93 17	90 08	86 59	83 49	52
56	...	...	...	...	...	...	...	...	108 12	104 32	100 52	97 13	56
60	...	...	...	...	...	...	...	...	...	...	...	111 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.77	2.67	2.57	2.48	2.39	2.31	2.22	2.15	2.07	2.00	1.93	1.86	$\triangle_1 h$
Log.	0.442 48	0.426 51	0.409 93	0.394 45	0.378 40	0.363 61	0.346 35	0.332 44	0.315 97	0.301 03	0.285 56	0.269 51	Log.
Limit	37	38	39	40	41	42	43	44	45	46	46	47	Minutes
Meridian	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	Altitudes

Latitude 1° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 29	0 27	0 27	0 26	0 25	0 24	0 22	0 22	0 22	0 21	0 20	0 19	4
8	1 55	1 51	1 47	1 42	1 40	1 36	1 33	1 29	1 26	1 23	1 20	1 16	8
12	4 19	4 09	4 00	3 51	3 45	3 36	3 28	3 20	3 13	3 06	2 59	2 51	12
16	7 41	7 23	7 08	6 53	6 39	6 24	6 08	5 56	5 43	5 30	5 17	5 05	16
20	12 00	11 32	11 08	10 44	10 24	10 00	9 36	9 16	8 56	8 36	8 16	7 56	20
24	17 17	16 36	16 02	15 28	14 59	14 24	13 49	13 21	12 52	12 23	11 54	11 26	24
28	23 31	22 37	21 49	21 02	20 23	19 36	18 49	18 10	17 30	16 52	16 12	15 33	28
32	30 43	29 32	28 30	27 28	26 37	25 36	24 35	23 43	22 52	22 01	21 10	20 18	32
36	38 53	37 22	36 05	34 47	33 42	32 24	31 06	30 02	28 57	27 52	26 47	25 43	36
40	48 00	46 08	44 32	42 56	41 36	40 00	38 24	37 04	35 44	34 24	33 04	31 44	40
44	58 05	55 49	53 54	51 57	50 20	48 24	46 27	44 51	43 14	41 37	40 00	38 24	44
48	69 07	66 24	64 07	61 49	59 54	57 36	55 18	53 22	51 27	49 32	47 37	45 41	48
52	81 07	77 58	75 15	72 33	70 18	67 36	64 54	62 38	60 23	58 08	55 53	53 37	52
56	94 05	90 25	87 18	84 09	81 32	78 24	75 15	72 39	70 02	67 25	64 48	62 12	56
60	108 00	103 48	100 12	96 36	93 36	90 00	86 24	83 24	80 24	77 24	74 24	71 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.80	1.73	1.67	1.61	1.56	1.50	1.44	1.39	1.34	1.29	1.24	1.19	$\triangle_1 h$
Log.	0.255 27	0.238 05	0.222 72	0.206 83	0.193 12	0.176 09	0.158 36	0.143 01	0.127 10	0.110 59	0.093 42	0.075 55	Log.
Limit	48	49	51	52	53	55	57	57	58	59	62	64	Minutes
Meridian	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 14	0 13	0 12	0 11	0 11	4
8	1 13	1 10	1 07	1 04	1 02	0 58	0 56	0 54	0 51	0 49	0 46	0 43	8
12	2 45	2 38	2 31	2 25	2 20	2 13	2 07	2 01	1 55	1 50	1 44	1 37	12
16	4 55	4 42	4 29	4 19	4 08	3 55	3 45	3 35	3 25	3 14	3 04	2 54	16
20	7 40	7 20	7 00	6 44	6 28	6 08	5 52	5 36	5 20	5 04	4 48	4 32	20
24	11 03	10 34	10 05	9 42	9 18	8 50	8 27	8 04	7 41	7 18	6 55	6 32	24
28	15 01	14 22	13 43	13 12	12 41	12 02	11 30	10 58	10 27	9 56	9 25	8 53	28
32	19 37	18 46	17 55	17 14	16 34	15 42	15 01	14 20	13 39	12 58	12 17	11 36	32
36	24 51	23 46	22 41	21 49	20 57	19 52	19 01	18 09	17 17	16 25	15 33	14 42	36
40	30 40	29 20	28 00	26 56	25 52	24 32	23 28	22 24	21 20	20 16	19 12	18 08	40
44	37 07	35 30	33 53	32 35	31 18	29 41	28 24	27 06	25 49	24 31	23 14	21 57	44
48	44 09	42 14	40 19	38 47	37 15	35 20	33 47	32 15	30 43	29 09	27 37	26 06	48
52	51 49	49 34	47 19	45 31	43 43	41 28	39 39	37 51	36 03	34 15	32 27	30 38	52
56	60 07	57 30	54 53	52 47	50 42	48 05	46 00	43 54	41 49	39 43	37 38	35 33	56
60	69 00	66 00	63 00	60 36	58 12	55 12	52 48	50 24	48 00	45 36	43 12	40 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.15	1.10	1.05	1.01	0.97	0.92	0.88	0.84	0.80	0.76	0.72	0.68	$\triangle_1 h$
Log.	0.060 70	0.041 39	0.021 19	0.004 32	9.986 77	9.963 79	9.944 48	9.924 28	9.903 09	9.880 81	9.857 33	9.832 51	Log.
Limit	66	68	70	72	74	76	78	80	82	84	86	88	Minutes
Meridian	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	Altitudes

Latitude 1° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	5 59	4 59	4 16	3 44	3 18	2 59	2 42	2 28	4
8	...	...	...	...	23 58	19 57	17 04	14 56	13 16	11 55	10 48	9 54	8
12	...	...	...	...	...	...	38 27	33 36	29 50	26 48	24 18	22 15	12
16	...	...	...	...	...	...	...	...	53 02	47 40	43 14	39 33	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	″
$\triangle_1 h$	...	...	...	...	22.47	18.71	16.02	14.00	12.43	11.17	10.13	9.27	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	1.351 60	1.272 07	1.204 66	1.146 13	1.094 47	1.048 05	1.005 61	0.967 08	Log.
Limit	1	3	5	7	8	9	10	11	12	13	14	15	Minutes
Meridian	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 17	2 06	1 58	1 50	1 43	1 37	1 31	1 26	1 23	1 18	1 15	1 11	4
8	9 07	8 26	7 51	7 20	6 53	6 29	6 07	5 48	5 29	5 13	4 58	4 45	8
12	20 30	18 58	17 40	16 31	15 29	14 36	13 45	13 02	12 21	11 44	11 11	10 40	12
16	36 26	33 45	31 24	29 21	27 31	25 56	24 27	23 10	21 59	20 52	19 53	18 56	16
20	56 56	52 44	49 04	45 52	43 00	40 32	38 12	36 12	34 20	32 36	31 04	29 36	20
24	...	...	...	66 03	61 55	58 22	55 00	52 07	49 27	46 57	44 45	42 37	24
28	...	...	...	...	84 17	79 27	74 53	70 58	67 17	63 54	60 53	58 01	28
32	...	...	...	...	...	...	...	...	...	83 27	79 31	75 47	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	8.54	7.91	7.36	6.88	6.45	6.08	5.73	5.43	5.15	4.89	4.66	4.44	$\triangle_1 h$
Log.	0.931 46	0.898 18	0.866 88	0.837 59	0.809 56	0.783 90	0.758 15	0.734 80	0.711 81	0.689 31	0.668 39	0.647 38	Log.
Limit	16	17	18	19	20	21	22	23	24	25	26	27	Minutes
Meridian	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	Altitudes

Latitude 1° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 08	1 05	1 02	0 59	0 57	0 54	0 53	0 51	0 49	0 47	0 46	0 44	4
8	4 32	4 20	4 09	4 00	3 49	3 40	3 31	3 23	3 16	3 08	3 02	2 56	8
12	10 11	9 45	9 20	8 57	8 36	8 14	7 55	7 38	7 21	7 04	6 49	6 35	12
16	18 05	17 19	16 36	15 55	15 16	14 38	14 05	13 34	13 03	12 32	12 07	11 41	16
20	28 16	27 04	25 56	24 52	23 52	22 52	22 00	21 12	20 24	19 36	18 56	18 16	20
24	40 42	38 59	37 21	35 48	34 22	32 55	31 41	30 32	29 23	28 13	27 16	26 18	24
28	55 24	53 03	50 50	48 45	46 47	44 50	43 07	41 33	39 59	38 25	37 06	35 48	28
32	72 22	69 17	66 23	63 40	61 06	58 33	56 19	54 16	52 13	50 11	48 28	46 46	32
36	...	...	...	...	77 20	74 05	71 17	68 42	66 06	63 30	61 21	59 11	36
40	...	...	...	...	...	91 28	88 00	84 48	81 36	78 24	75 44	73 04	40
44	...	...	...	...	...	...	...	...	...	...	...	88 24	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.24	4.06	3.89	3.73	3.58	3.43	3.30	3.18	3.06	2.94	2.84	2.74	$\triangle_1 h$
Log.	0.627 37	0.608 53	0.589 95	0.571 71	0.553 88	0.535 29	0.518 51	0.502 43	0.485 72	0.468 35	0.453 32	0.437 75	Log.
Limit	28	29	30	31	32	33	34	34	35	36	37	38	Minutes
Meridian	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 41	0 39	0 38	0 36	0 35	0 35	0 33	0 32	0 30	0 30	0 29	4
8	2 49	2 43	2 38	2 32	2 27	2 22	2 17	2 13	2 08	2 03	1 59	1 55	8
12	6 20	6 07	5 55	5 41	5 30	5 18	5 08	4 58	4 48	4 38	4 28	4 19	12
16	11 16	10 53	10 29	10 07	9 46	9 26	9 08	8 50	8 32	8 14	7 56	7 41	16
20	17 36	17 00	16 24	15 48	15 16	14 44	14 16	13 48	13 20	12 52	12 24	12 00	20
24	25 21	24 29	23 37	22 45	21 59	21 13	20 33	19 52	19 12	18 31	17 52	17 17	24
28	34 29	33 19	32 09	30 58	29 56	28 53	27 57	27 03	26 08	25 14	24 18	23 31	28
32	45 03	43 31	41 59	40 27	39 05	37 43	36 31	35 20	34 08	32 57	31 44	30 43	32
36	57 02	55 05	53 08	51 12	49 28	47 44	46 14	44 43	43 12	41 41	40 11	38 53	36
40	70 24	68 00	65 36	63 12	61 04	58 56	57 04	55 12	53 20	51 28	49 36	48 00	40
44	85 11	82 17	79 22	76 39	73 53	71 18	69 03	66 48	64 32	62 16	60 01	58 05	44
48	...	...	94 28	91 00	87 56	84 52	82 10	79 29	76 48	74 07	71 25	69 07	48
52	...	...	...	106 48	103 12	99 36	96 26	93 17	90 08	86 59	83 49	81 07	52
56	...	...	...	...	...	...	...	108 12	104 32	100 52	97 13	94 05	56
60	...	...	...	...	...	...	...	...	...	...	111 36	108 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.64	2.55	2.46	2.37	2.29	2.21	2.14	2.07	2.00	1.93	1.86	1.80	$\triangle_1 h$
Log.	0.421 60	0.406 54	0.390 94	0.374 75	0.359 84	0.344 39	0.330 41	0.315 97	0.301 03	0.285 56	0.269 51	0.255 27	Log.
Limit	38	39	40	41	41	42	43	44	45	46	47	48	Minutes
Meridian	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 27	0 26	0 25	0 24	0 23	0 22	0 22	0 21	0 20	0 19	0 19	4
8	1 52	1 47	1 43	1 40	1 36	1 34	1 30	1 27	1 23	1 21	1 17	1 15	8
12	4 11	4 02	3 53	3 45	3 37	3 31	3 23	3 16	3 08	3 02	2 54	2 48	12
16	7 25	7 10	6 55	6 39	6 27	6 13	6 01	5 48	5 36	5 22	5 10	5 00	16
20	11 36	11 12	10 48	10 24	10 04	9 44	9 24	9 04	8 44	8 24	8 04	7 48	20
24	16 42	16 08	15 34	14 59	14 30	14 01	13 32	13 04	12 35	12 06	11 37	11 14	24
28	22 44	21 57	21 10	20 23	19 44	19 05	18 26	17 46	17 07	16 28	15 49	15 17	28
32	29 42	28 40	27 38	26 37	25 46	24 55	24 04	23 12	22 21	21 30	20 39	19 58	32
36	37 35	36 18	35 00	33 42	32 37	31 32	30 27	29 23	28 18	27 13	26 08	25 17	36
40	46 24	44 48	43 12	41 36	40 16	38 56	37 36	36 16	34 56	33 36	32 16	31 12	40
44	56 08	54 13	52 17	50 20	48 43	47 06	45 29	43 53	42 16	40 39	39 02	37 46	44
48	66 47	64 30	62 12	59 54	57 59	56 04	54 09	52 13	50 18	46 23	46 28	44 55	48
52	78 25	75 42	73 00	70 18	68 03	65 48	63 33	61 17	59 02	56 47	54 32	52 43	52
56	90 56	87 49	84 41	81 32	78 55	76 18	73 41	71 05	68 28	65 51	63 14	61 10	56
60	104 24	100 48	97 12	93 36	90 36	87 36	84 36	81 36	78 36	75 36	72 36	70 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.74	1.68	1.62	1.56	1.51	1.46	1.41	1.36	1.31	1.26	1.21	1.17	$\triangle_1$h
Log.	0.240 55	0.225 31	0.209 52	0.193 12	0.178 98	0.164 35	0.149 22	0.133 54	0.117 27	0.100 37	0.082 79	0.068 19	Log.
Limit	49	50	52	54	55	56	57	59	60	62	64	66	Minutes
Meridian	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 17	0 16	0 15	0 15	0 14	0 14	0 13	0 12	0 12	0 11	0 11	4
8	1 11	1 09	1 06	1 03	1 01	0 58	0 55	0 53	0 51	0 48	0 45	0 42	8
12	2 41	2 36	2 28	2 23	2 17	2 11	2 05	1 59	1 54	1 48	1 42	1 36	12
16	4 47	4 36	4 24	4 13	4 03	3 53	3 43	3 33	3 22	3 12	3 02	2 52	16
20	7 28	7 12	6 52	6 36	6 20	6 04	5 48	5 32	5 16	5 00	4 44	4 28	20
24	10 46	10 22	9 53	9 30	9 07	8 44	8 21	7 58	7 35	7 12	6 49	6 26	24
28	14 38	14 07	13 28	12 57	12 25	11 54	11 22	10 51	10 20	9 48	9 17	8 45	28
32	19 06	18 26	17 35	16 54	16 13	15 32	14 51	14 10	13 29	12 48	12 07	11 26	32
36	24 12	23 20	22 15	21 23	20 31	19 39	18 48	17 56	17 04	16 12	15 20	14 29	36
40	29 52	28 48	27 28	26 24	25 20	24 16	23 12	22 08	21 04	20 00	18 56	17 52	40
44	36 09	34 51	33 14	31 56	30 39	29 21	28 05	26 47	25 29	24 12	22 54	21 38	44
48	43 00	41 28	39 33	38 01	36 29	34 57	33 24	31 52	30 18	28 46	27 14	25 43	48
52	50 28	48 40	46 25	44 37	42 49	41 01	39 12	37 24	35 36	33 48	32 00	30 11	54
56	58 33	56 27	53 50	51 44	49 39	47 33	45 29	43 23	41 17	39 12	37 06	35 02	56
60	67 12	64 48	61 48	59 24	57 00	54 36	52 12	49 48	47 24	45 00	42 36	40 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.12	1.08	1.03	0.99	0.95	0.91	0.87	0.83	0.79	0.75	0.71	0.67	$\triangle_1$h
Log.	0.049 22	0.033 42	0.012 84	9.995 64	9.977 72	9.959 04	9.939 52	9.919 08	9.897 63	9.875 06	9.851 26	9.826 07	Log.
Limit	67	69	71	73	75	77	80	82	84	86	90	93	Minutes
Meridian	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	5 58	4 57	4 14	3 42	3 17	4
8	...	...	...	...	...	...	...	23 50	19 50	16 57	14 49	13 08	8
12	...	...	...	...	...	...	...	...	...	38 10	33 20	29 32	12
16	...	...	...	...	...	...	...	...	...	...	...	52 32	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	...	...	...	22.35	18.59	15.90	13.89	12.31	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.349 28	1.269 28	1.201 40	1.142 70	1.090 26	Log.
Limit	3	1	0	1	3	5	7	8	9	10	11	12	Minutes
Meridian	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 57	2 40	2 27	2 14	2 05	1 56	1 49	1 42	1 35	1 30	1 25	1 21	4
8	11 47	10 41	9 46	9 00	8 19	7 44	7 14	6 46	6 22	6 00	5 40	5 23	8
12	26 31	24 03	21 59	20 14	18 43	17 24	16 15	15 14	14 20	13 30	12 46	12 06	12
16	47 09	42 45	39 05	35 58	33 17	30 56	28 53	27 06	25 28	24 02	22 42	21 30	16
20	...	...	...	56 12	52 00	48 20	45 08	42 20	39 48	37 32	35 28	33 36	20
24	...	...	...	...	...	...	64 59	60 58	57 18	54 03	51 05	48 23	24
28	...	...	...	...	...	...	...	82 59	78 01	73 34	69 31	65 51	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	11.05	10.02	9.16	8.43	7.80	7.25	6.77	6.35	5.97	5.63	5.32	5.04	$\triangle_1$h
Log.	1.043 36	1.000 87	0.961 90	0.925 83	0.892 09	0.860 34	0.830 59	0.802 77	0.775 97	0.750 51	0.725 91	0.702 43	Log.
Limit	13	14	15	16	17	18	19	20	22	23	24	25	Minutes
Meridian	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 16	1 13	1 10	1 07	1 03	1 00	0 58	0 55	0 53	0 51	0 49	0 47	4
8	5 07	4 51	4 38	4 25	4 12	4 02	3 51	3 43	3 33	3 25	3 17	3 09	8
12	11 30	10 55	10 25	9 56	9 29	9 05	8 41	8 20	7 59	7 41	7 22	7 05	12
16	20 26	19 25	18 31	17 40	16 51	16 07	15 27	14 48	14 13	13 39	13 06	12 35	16
20	31 56	30 20	28 56	27 36	26 20	25 12	24 08	23 08	22 12	21 20	20 28	19 40	20
24	45 59	43 41	41 40	39 45	37 55	36 17	34 46	33 18	31 58	30 43	29 28	28 19	24
28	62 34	59 27	56 42	54 05	51 37	49 24	47 18	45 21	43 31	41 49	40 07	38 33	28
32	81 45	77 39	74 04	70 39	67 25	64 31	61 46	59 14	56 50	54 37	52 24	50 21	32
36	...	...	...	...	...	...	78 12	74 57	71 56	69 07	66 19	63 43	36
40	...	...	...	...	...	...	...	92 32	88 48	85 20	81 52	78 40	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.79	4.55	4.34	4.14	3.95	3.78	3.62	3.47	3.33	3.20	3.07	2.95	$\triangle_1 h$
Log.	0.680 34	0.658 01	0.637 49	0.617 00	0.596 60	0.577 49	0.558 71	0.540 33	0.522 44	0.505 15	0.487 14	0.469 82	Log.
Limit	26	27	28	29	30	31	31	32	33	34	35	36	Minutes
Meridian	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 46	0 43	0 42	0 40	0 39	0 38	0 36	0 35	0 34	0 32	0 31	0 30	4
8	3 02	2 55	2 48	2 42	2 37	2 30	2 26	2 20	2 15	2 10	2 05	2 01	8
12	6 49	6 33	6 18	6 04	5 52	5 38	5 27	5 15	5 03	4 52	4 43	4 32	12
16	12 07	11 39	11 14	10 48	10 24	10 02	9 41	9 21	9 01	8 40	8 21	8 04	16
20	18 56	18 12	17 32	16 52	16 16	15 40	15 08	14 36	14 04	13 32	13 04	12 36	20
24	27 16	26 12	25 15	24 17	23 25	22 34	21 47	21 02	20 16	19 29	18 49	18 09	24
28	37 06	35 41	34 22	33 04	31 53	30 42	29 40	28 37	27 34	26 32	25 37	24 42	28
32	48 28	46 36	44 53	43 11	41 39	40 06	38 45	37 22	36 00	34 39	33 27	32 15	32
36	61 21	58 58	56 49	54 39	52 42	50 46	49 02	47 19	45 35	43 51	42 20	40 50	36
40	75 44	72 48	70 08	67 28	65 04	62 40	60 32	58 24	56 16	54 08	52 16	50 24	40
44	...	88 05	84 52	81 38	78 43	75 50	73 15	70 40	68 05	65 30	63 14	60 59	44
48	...	...	...	...	93 42	90 14	87 10	84 05	81 01	77 57	75 16	72 34	48
52	...	...	...	...	...	105 54	102 18	98 41	95 05	91 29	88 20	85 10	52
56	...	...	...	...	...	...	...	...	...	106 06	102 26	98 47	56
60	...	...	...	...	...	...	...	...	...	...	...	113 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.84	2.73	2.63	2.53	2.44	2.35	2.27	2.19	2.11	2.03	1.96	1.89	$\triangle_1 h$
Log.	0.453 32	0.436 16	0.419 96	0.403 12	0.387 39	0.371 07	0.356 03	0.340 44	0.324 28	0.307 50	0.292 26	0.276 46	Log.
Limit	37	38	39	40	41	42	43	44	45	45	46	47	Minutes
Meridian	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	Altitudes

Latitude 2° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 29	0 28	0 27	0 27	0 25	0 24	0 23	0 22	0 22	0 21	0 20	0 19	4
8	1 57	1 53	1 49	1 45	1 41	1 37	1 34	1 30	1 27	1 23	1 20	1 17	8
12	4 23	4 14	4 05	3 56	3 48	3 39	3 31	3 23	3 16	3 07	3 00	2 54	12
16	7 49	7 30	7 15	7 00	6 44	6 29	6 13	6 01	5 48	5 33	5 20	5 10	16
20	12 12	11 44	11 20	10 56	10 32	10 08	9 44	9 24	9 04	8 40	8 20	8 04	20
24	17 34	16 54	16 19	15 45	15 10	14 36	14 01	13 32	13 04	12 29	12 00	11 37	24
28	23 55	23 00	22 13	21 25	20 39	19 52	19 05	18 26	17 46	16 59	16 20	15 49	28
32	31 13	30 02	29 01	27 59	26 58	25 56	24 55	24 04	23 12	22 11	21 20	20 39	32
36	39 32	38 01	36 43	35 26	34 08	32 50	31 32	30 27	29 23	28 05	27 00	26 08	36
40	48 48	46 56	45 20	43 44	42 08	40 32	38 56	37 36	36 16	34 40	33 20	32 16	40
44	59 03	56 47	54 51	52 55	50 59	49 03	47 06	45 29	43 53	41 57	40 20	39 02	44
48	70 16	67 33	65 15	62 58	60 40	58 22	56 04	54 09	52 13	49 55	48 00	46 28	48
52	82 28	79 19	76 37	73 54	71 12	68 30	65 48	63 33	61 17	58 35	56 20	54 32	52
56	95 39	91 59	88 51	85 43	82 35	79 27	76 18	73 41	71 05	67 57	65 20	63 14	56
60	109 48	105 36	102 00	98 24	94 48	91 12	87 36	84 36	81 36	78 00	75 00	72 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.83	1.76	1.70	1.64	1.58	1.52	1.46	1.41	1.36	1.30	1.25	1.21	$\Delta_1 h$
Log.	0.262	0.245	0.230	0.214	0.198	0.181	0.164	0.149	0.133	0.113	0.096	0.082	Log.
	45	51	45	84	66	84	35	22	54	94	91	79	
Limit	48	49	50	52	53	55	56	57	58	59	61	63	Minutes
Meridian	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 13	0 13	0 12	0 11	0 11	4
8	1 14	1 11	1 08	1 05	1 02	0 59	0 57	0 54	0 51	0 49	0 46	0 43	8
12	2 47	2 39	2 33	2 27	2 20	2 14	2 08	2 01	1 55	1 50	1 44	1 37	12
16	4 57	4 45	4 31	4 21	4 08	3 58	3 48	3 35	3 25	3 14	3 04	2 54	16
20	7 44	7 24	7 04	6 48	6 28	6 12	5 56	5 36	5 20	5 04	4 48	4 32	20
24	11 09	10 40	10 11	9 48	9 18	8 55	8 33	8 04	7 41	7 18	6 55	6 32	24
28	15 09	14 30	13 51	13 20	12 41	12 10	11 38	10 58	10 27	9 56	9 25	8 53	28
32	19 47	18 56	18 05	17 24	16 34	15 53	15 11	14 20	13 39	12 58	12 17	11 36	32
36	25 04	23 59	22 54	22 02	20 57	20 05	19 14	18 09	17 17	16 25	15 33	14 42	36
40	30 56	29 36	28 16	27 12	25 52	24 48	23 44	22 24	21 20	20 16	19 12	18 08	40
44	37 26	35 49	34 12	32 55	31 18	30 00	28 43	27 06	25 49	24 31	23 14	21 57	44
48	44 32	42 37	40 42	39 10	37 15	35 43	34 10	32 15	30 43	29 09	27 37	26 06	48
52	52 16	50 01	47 46	45 58	43 43	41 55	40 06	37 51	36 03	34 15	32 27	30 38	52
56	60 38	58 01	55 24	53 19	50 42	48 36	46 31	43 54	41 49	39 43	37 38	35 33	56
60	69 36	66 36	63 36	61 12	58 12	55 48	53 24	50 24	48 00	45 36	43 12	40 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.16	1.11	1.06	1.02	0.97	0.93	0.89	0.84	0.80	0.76	0.72	0.68	$\Delta_1 h$
Log.	0.064	0.045	0.025	0.008	9.986	9.968	9.949	9.924	9.903	9.880	9.857	9.832	Log.
	46	32	31	60	77	48	39	28	09	81	33	51	
Limit	65	67	69	71	73	75	78	80	82	84	86	88	Minutes
Meridian	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	Altitudes

Latitude 2° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	5 59	5 00	4 17	3 44	3 19	2 59	2 43	2 28	2 17	4
8	...	...	...	23 59	19 59	17 07	14 57	13 17	11 56	10 50	9 55	9 08	8
12	...	...	...	...	...	38 30	33 39	29 53	26 51	24 23	22 18	20 33	12
16	...	...	...	...	...	...	59 49	53 07	47 45	43 21	39 38	36 31	16
20	...	...	...	...	...	...	...	...	...	...	...	57 04	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	22.48	18.73	16.04	14.02	12.45	11 19	10.16	9.29	8.56	$\Delta_1 h$
Log.	... ...	... ...	... ...	1.351 80	1.272 54	1.205 20	1.146 75	1.095 17	1.048 83	1.006 89	0.968 02	0.932 47	Log.
Limit	3	4	5	7	9	10	11	12	13	14	15	16	Minutes
Meridian.	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 06	1 58	1 50	1 43	1 38	1 32	1 27	1 23	1 18	1 15	1 11	1 08	4
8	8 27	7 53	7 22	6 55	6 30	6 09	5 50	5 31	5 14	5 00	4 47	4 34	8
12	9 02	17 44	16 35	15 34	14 38	13 50	13 07	12 26	11 49	11 15	10 44	10 15	12
16	33 50	31 32	29 29	27 38	26 02	24 34	23 17	22 06	20 59	20 01	19 04	18 13	16
20	52 52	49 16	46 04	43 12	40 40	38 24	36 24	34 32	32 48	31 16	29 48	28 28	20
24	...	...	66 20	62 12	58 34	55 18	52 25	49 44	47 14	45 02	42 53	40 59	24
28	...	...	...	...	79 42	75 16	71 21	67 41	64 18	61 17	58 25	55 48	28
32	...	...	...	...	...	...	...	...	...	80 02	76 18	72 53	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	7.93	7.39	6.91	6.48	6.10	5.76	5.46	5.18	4.92	4.69	4.47	4.27	$\Delta_1 h$
Log.	0.899 27	0.868 64	0.839 48	0.811 58	0.785 33	0.760 42	0.737 19	0.714 33	0 691 97	0.671 17	0.650 31	0.630 43	Log.
Limit	17	18	19	20	21	22	23	24	25	26	27	28	Minutes
Meridian	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	Altitudes

Latitude 2° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 05	1 02	1 00	0 58	0 55	0 53	0 51	0 49	0 47	0 46	0 44	0 43	4
8	4 22	4 10	4 01	3 51	3 43	3 33	3 26	3 18	3 10	3 04	2 58	2 51	8
12	9 49	9 25	9 02	8 39	8 20	7 59	7 42	7 25	7 10	6 53	6 39	6 24	12
16	17 27	16 43	16 02	15 25	14 48	14 13	13 42	13 11	12 42	12 15	11 49	11 24	16
20	27 16	26 08	25 04	24 04	23 08	22 12	21 24	20 36	19 52	19 08	18 28	17 48	20
24	39 16	37 38	36 06	34 40	33 18	31 58	30 49	29 40	28 36	27 33	26 35	25 38	24
28	53 27	51 14	49 08	47 10	45 21	43 31	41 57	40 23	38 57	37 30	36 12	34 53	28
32	69 48	66 54	64 10	61 36	59 14	56 50	54 47	52 44	50 52	48 59	47 17	45 34	32
36	...	...	...	77 59	74 57	71 56	69 20	66 45	64 22	62 00	59 50	57 41	36
40	...	...	...	...	92 32	88 48	85 36	82 24	79 28	76 32	73 52	71 12	40
44	...	...	...	...	...	...	...	...	...	...	...	86 10	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	. .	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	4.09	3.92	3.76	3.61	3.47	3.33	3.21	3.09	2.98	2.87	2.77	2.67	△₁h
Log.	0.611 72	0.593 29	0.575 19	0.557 51	0.540 33	0.522 44	0.506 51	0.489 96	0.474 22	0.457 88	0.442 48	0.426 51	Log.
Limit	29	30	31	32	33	34	35	36	37	38	39	39	Minutes
Meridian	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 41	0 39	0 38	0 37	0 36	0 35	0 34	0 32	0 31	0 30	0 29	0 28	4
8	2 45	2 40	2 35	2 28	2 24	2 19	2 14	2 10	2 05	2 01	1 57	1 54	8
12	6 12	5 59	5 47	5 34	5 24	5 12	5 02	4 52	4 43	4 34	4 23	4 16	12
16	11 00	10 37	10 17	9 54	9 36	9 16	8 58	8 40	8 21	8 06	7 49	7 33	16
20	17 12	16 36	16 04	15 28	15 00	14 28	14 00	13 32	13 04	12 40	12 12	11 48	20
24	24 46	23 54	23 08	22 17	21 36	20 50	20 10	19 29	18 49	18 14	17 34	16 59	24
28	33 43	32 33	31 30	30 19	29 24	28 21	27 26	26 32	25 37	24 50	23 55	23 08	28
32	44 02	42 30	41 08	39 35	38 24	37 02	35 50	34 39	33 27	32 26	31 13	30 13	32
36	55 44	53 47	52 03	50 07	48 36	46 53	45 22	43 51	42 20	41 02	39 32	38 14	36
40	68 48	66 24	64 16	61 52	60 00	57 52	56 00	54 08	52 16	50 40	48 48	47 12	40
44	83 15	80 20	77 45	74 52	72 36	70 02	67 46	65 30	63 14	61 18	59 03	57 07	44
48	...	95 37	92 33	89 05	86 24	83 19	80 38	77 57	75 16	72 58	70 16	67 56	48
52	...	...	...	104 33	101 24	97 47	94 38	91 29	88 20	85 38	82 28	79 46	52
56	...	...	...	...	...	...	...	106 06	102 26	99 18	95 39	92 31	56
60	...	...	...	...	...	...	...	...	...	114 00	109 48	106 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.58	2.49	2.41	2.32	2.25	2.17	2.10	2.03	1.96	1.90	1.83	1.77	△₁h
Log.	0.411 62	0.396 20	0.382 02	0.365 49	0.352 18	0.336 46	0.322 22	0.307 50	0.292 26	0.278 75	0.262 45	0.247 97	Log.
Limit	39	40	41	42	42	43	44	45	46	46	48	49	Minutes
Meridian	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 26	0 25	0 23	0 22	0 22	0 22	0 20	0 20	0 19	0 19	4
8	1 50	1 46	1 42	1 39	1 36	1 33	1 29	1 26	1 23	1 20	1 17	1 14	8
12	4 06	3 59	3 50	3 42	3 35	3 28	3 20	3 13	3 06	3 00	2 53	2 47	12
16	7 18	7 05	6 50	6 34	6 21	6 08	5 56	5 43	5 30	5 20	5 07	4 57	16
20	11 24	11 04	10 40	10 16	9 56	9 36	9 16	8 56	8 36	8 20	8 00	7 44	20
24	16 25	15 57	15 22	14 47	14 18	13 49	13 21	12 52	12 23	12 00	11 31	11 09	24
28	22 21	21 41	20 54	20 07	19 29	18 49	18 10	17 30	16 52	16 20	15 41	15 09	28
32	29 11	28 19	27 18	26 17	25 26	24 35	23 43	22 52	22 01	21 20	20 29	19 47	32
36	36 56	35 52	34 34	33 16	32 11	31 06	30 02	28 57	27 52	27 00	25 55	25 04	36
40	45 36	44 16	42 40	41 04	39 44	38 24	37 04	35 44	34 24	33 20	32 00	30 56	40
44	55 10	53 34	51 38	49 41	48 04	46 27	44 51	43 14	41 37	40 20	38 43	37 26	44
48	65 38	63 44	61 26	59 08	57 13	55 18	53 22	51 27	49 32	48 00	46 05	44 32	48
52	77 04	74 48	72 06	69 24	67 09	64 54	62 38	60 23	58 08	56 20	54 05	52 16	52
56	89 22	86 46	83 38	80 29	77 52	75 15	72 39	70 02	67 25	65 20	62 43	60 38	56
60	102 36	99 36	96 00	92 24	89 24	86 24	83 24	80 24	77 24	75 00	72 00	69 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.71	1.66	1.60	1.54	1.49	1.44	1.39	1.34	1.29	1.25	1.20	1.16	$\triangle_1 h$
Log.	0.233 00	0.220 11	0.204 12	0.187 52	0.173 19	0.158 36	0.143 01	0.127 10	0.110 59	0.096 91	0.079 18	0.064 46	Log.
Limit	50	51	53	55	56	57	58	60	61	63	65	67	Minutes
Meridian	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 17	0 16	0 15	0 15	0 14	0 14	0 13	0 12	0 12	0 11	0 11	4
8	1 11	1 08	1 05	1 02	1 00	0 57	0 55	0 52	0 50	0 47	0 45	0 43	8
12	2 39	2 34	2 27	2 22	2 16	2 10	2 04	1 58	1 52	1 47	1 42	1 37	12
16	4 45	4 34	4 21	4 10	4 00	3 50	3 40	3 30	3 19	3 09	3 02	2 54	16
20	7 24	7 08	6 48	6 32	6 16	6 00	5 44	5 28	5 12	4 56	4 44	4 32	20
24	10 40	10 16	9 48	9 24	9 01	8 38	8 16	7 53	7 29	7 06	6 49	6 32	24
28	14 30	13 59	13 20	12 49	12 17	11 46	11 14	10 43	10 12	9 40	9 17	8 53	28
32	18 56	18 16	17 24	16 44	16 03	15 22	14 40	13 59	13 19	12 38	12 07	11 36	32
36	23 59	23 07	22 02	21 10	20 18	19 26	18 35	17 43	16 51	15 59	15 20	14 42	36
40	29 36	28 32	27 12	26 08	25 04	24 00	22 56	21 52	20 48	19 44	18 56	18 08	40
44	35 49	34 32	32 55	31 37	30 19	29 02	27 45	26 28	25 10	23 52	22 54	21 57	44
48	42 37	41 05	39 10	37 38	36 06	34 34	33 01	31 29	29 55	28 23	27 14	26 06	48
52	50 01	48 13	45 58	44 10	42 22	40 34	38 45	36 57	35 09	33 21	32 00	30 38	52
56	58 01	55 56	53 19	51 13	49 07	47 02	44 57	42 52	40 46	38 40	37 06	35 33	56
60	66 36	64 12	61 12	58 48	56 24	54 00	51 36	49 12	46 48	44 24	42 36	40 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.11	1.07	1.02	0.98	0.94	0.90	0.86	0.82	0.78	0.74	0.71	0.68	$\triangle_1 h$
Log.	0.045 32	0.029 38	0.008 60	9.991 23	9.973 13	9.954 24	9.934 50	9.913 81	9.892 09	9.869 23	9.851 26	9.832 51	Log.
Limit	69	70	72	74	76	78	80	82	84	86	90	93	Minutes
Meridian	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	Altitudes

Latitude 3° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	5 56	4 57	4 14	3 42	4
8	...	...	...	...	...	...	...	...	23 46	19 46	16 54	14 45	8
12	...	...	...	...	...	...	...	...	...	...	38 01	33 11	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	...	22.28	18.53	15.84	13.83	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.347 92	1.267 88	1.199 76	1.140 82	Log.
Limit	4	2	1	0	1	3	5	7	8	9	10	11	Minutes
Meridian	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 16	2 56	2 39	2 26	2 14	2 04	1 55	1 47	1 41	1 34	1 29	1 24	4
8	13 05	11 44	10 38	9 43	8 56	8 16	7 42	7 11	6 43	6 18	5 57	5 38	8
12	29 26	26 24	23 56	21 51	20 07	18 36	17 18	16 09	15 07	14 13	13 24	12 41	12
16	...	...	42 32	38 53	35 45	33 04	30 46	28 43	26 53	25 15	23 48	22 31	16
20	...	...	...	...	55 52	51 40	48 04	44 52	42 00	39 28	37 12	35 12	20
24	...	...	...	...	...	...	...	64 36	60 29	56 50	53 34	50 41	24
28	...	...	...	...	...	...	...	...	82 19	77 22	72 53	69 00	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	12.26	11.00	9.97	9.11	8.38	7.75	7.21	6.73	6.30	5.92	5.58	5.28	$\triangle_1 h$
Log.	1.088 49	1.041 39	0.998 70	0.959 52	0.923 24	0.889 30	0.857 94	0.828 02	0.799 34	0.772 32	0.746 63	0.722 63	Log.
Limit	12	13	14	15	17	18	19	20	22	23	24	25	Minutes
Meridian	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	Altitudes

Latitude 3° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 20	1 16	1 12	1 09	1 06	1 02	1 00	0 57	0 54	0 52	0 51	0 48	4
8	5 20	5 04	4 49	4 35	4 22	4 10	4 00	3 49	3 40	3 31	3 22	3 14	8
12	12 00	11 24	10 49	10 19	9 50	9 23	8 59	8 36	8 14	7 54	7 35	7 16	12
16	21 20	20 13	19 15	18 21	17 30	16 41	15 57	15 16	14 38	14 02	13 29	12 56	16
20	33 20	31 36	30 04	28 40	27 20	26 04	24 56	23 52	22 52	21 56	21 04	20 12	20
24	48 00	45 30	43 18	41 17	39 22	37 32	35 54	34 22	32 55	31 35	30 21	29 05	24
28	65 20	61 54	58 56	56 11	53 34	51 06	48 52	46 47	44 50	43 00	41 17	39 36	28
32	...	80 54	76 58	73 23	69 58	66 44	63 50	61 06	58 33	56 09	53 55	51 43	32
36	...	...	...	...	...	...	...	77 20	74 05	71 04	68 16	65 27	36
40	...	...	...	...	...	...	...	...	91 28	87 44	84 16	80 48	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	5.00	4.74	4.51	4.30	4.10	3.91	3.74	3.58	3.43	3.29	3.16	3.03	$\Delta_1 h$
Log.	0.698 97	0.675 78	0.654 18	0.633 47	0.612 78	0.592 18	0.572 87	0.553 88	0.535 29	0.517 20	0.499 69	0.481 44	Log.
Limit	25	26	27	28	29	30	31	32	33	34	35	36	Minutes
Meridian	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 46	0 45	0 43	0 41	0 40	0 38	0 37	0 35	0 35	0 33	0 32	0 30	4
8	3 06	2 59	2 52	2 46	2 40	2 34	2 28	2 23	2 17	2 13	2 08	2 03	8
12	6 59	6 43	6 27	6 13	6 00	5 46	5 34	5 21	5 09	4 58	4 48	4 38	12
16	12 25	11 57	11 29	11 03	10 40	10 14	9 54	9 31	9 11	8 50	8 34	8 14	16
20	19 24	18 40	17 56	17 16	16 40	16 00	15 28	14 52	14 20	13 48	13 20	12 52	20
24	27 56	26 53	25 50	24 52	24 00	23 02	22 17	21 24	20 39	19 52	19 12	18 31	24
28	38 02	36 35	35 09	33 51	32 40	31 22	30 19	29 09	28 05	27 03	26 08	25 14	28
32	49 40	47 47	45 54	44 12	42 40	40 58	39 35	38 04	36 41	35 20	34 08	32 57	32
36	62 51	60 29	58 07	55 57	54 00	51 50	50 07	48 10	46 27	44 43	43 12	41 41	36
40	77 36	74 40	71 44	69 04	66 40	64 00	61 52	59 28	57 20	55 12	53 20	51 28	40
44	...	...	86 48	83 34	80 40	77 26	74 52	71 57	69 23	66 48	64 32	62 16	44
48	...	...	...	...	96 00	92 10	89 05	85 38	82 33	79 29	76 48	74 07	48
52	...	...	...	...	...	...	104 33	100 30	96 53	93 17	90 08	86 59	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.91	2.80	2.69	2.59	2.50	2.40	2.32	2.23	2.15	2.07	2.00	1.93	$\Delta_1 h$
Log.	0.463 89	0.447 16	0.429 75	0.413 30	0.397 94	0.380 21	0.365 49	0.348 30	0.332 44	0.315 97	0.301 03	0.285 56	Log.
Limit	36	37	38	39	40	41	42	43	44	45	46	47	Minutes
Meridian	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	Altitudes

Latitude 3° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 28	0 27	0 27	0 26	0 25	0 23	0 22	0 22	0 21	0 20	0 19	4
8	1 59	1 55	1 50	1 46	1 42	1 39	1 35	1 32	1 28	1 24	1 21	1 18	8
12	4 28	4 18	4 08	3 59	3 50	3 42	3 34	3 24	3 17	3 10	3 03	2 56	12
16	7 56	7 38	7 20	7 05	6 50	6 34	6 18	6 06	5 51	5 38	5 25	5 12	16
20	12 24	11 56	11 28	11 04	10 40	10 16	9 52	9 32	9 08	8 48	8 28	8 08	20
24	17 52	17 11	16 31	15 57	15 22	14 47	14 12	13 43	13 09	12 41	12 11	11 43	24
28	24 18	23 24	22 29	21 41	20 54	20 07	19 21	18 42	17 54	17 15	16 36	15 57	28
32	31 44	30 33	29 21	28 19	27 18	26 17	25 16	24 25	23 23	22 31	21 41	20 49	32
36	40 11	38 40	37 09	35 52	34 34	33 16	31 58	30 53	29 36	28 31	27 26	26 21	36
40	49 36	47 44	45 52	44 16	42 40	41 04	39 28	38 08	36 32	35 12	33 52	32 32	40
44	60 01	57 45	55 30	53 34	51 38	49 41	47 45	46 08	44 13	42 36	40 59	39 22	44
48	71 25	68 42	66 01	63 44	61 26	59 08	56 50	54 55	52 36	50 41	48 46	46 51	48
52	83 49	80 40	77 31	74 48	72 06	69 24	66 42	64 27	61 44	59 29	57 14	54 59	52
56	97 13	93 33	89 54	86 46	83 38	80 29	77 21	74 44	71 37	69 00	66 23	63 46	56
60	111 36	107 24	103 12	99 36	96 00	92 24	88 48	85 48	82 12	79 12	76 12	73 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.86	1.79	1.72	1.66	1.60	1.54	1.48	1.43	1.37	1.32	1.27	1.22	$\triangle_1 h$
Log.	0.269 51	0.252 85	0.235 53	0.220 11	0.204 12	0.187 52	0.170 26	0.155 34	0.136 72	0.120 57	0.103 80	0.086 36	Log.
Limit	48	49	50	51	53	55	56	57	58	59	61	63	Minutes
Meridian	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 14	0 13	0 12	0 11	0 11	4
8	1 15	1 11	1 08	1 06	1 02	0 59	0 57	0 54	0 51	0 50	0 47	0 44	8
12	2 48	2 41	2 34	2 28	2 22	2 14	2 08	2 02	1 56	1 51	1 45	1 39	12
16	5 00	4 47	4 34	4 24	4 10	3 58	3 48	3 38	3 28	3 17	3 07	2 57	16
20	7 48	7 28	7 08	6 52	6 32	6 12	5 56	5 40	5 24	5 08	4 52	4 36	20
24	11 14	10 46	10 16	9 53	9 24	8 55	8 33	8 10	7 47	7 23	7 00	6 38	24
28	15 17	14 38	13 59	13 28	12 49	12 10	11 38	11 06	10 35	10 04	9 33	9 01	28
32	19 58	19 06	18 16	17 35	16 44	15 53	15 11	14 30	13 49	13 09	12 28	11 46	32
36	25 17	24 12	23 07	22 15	21 10	20 05	19 14	18 22	17 30	16 38	15 46	14 55	36
40	31 12	29 52	28 32	27 28	26 08	24 48	23 44	22 40	21 36	20 32	19 28	18 24	40
44	37 46	36 09	34 32	33 14	31 37	30 00	28 43	27 26	26 08	24 51	23 33	22 16	44
48	44 55	43 00	41 05	39 33	37 38	35 43	34 10	32 38	31 06	29 32	28 00	26 29	48
52	52 43	50 28	48 13	46 25	44 10	41 55	40 06	38 18	36 30	34 42	32 54	31 05	52
56	61 10	58 33	55 56	53 50	51 13	48 36	46 31	44 26	42 20	40 15	38 09	36 04	56
60	70 12	67 12	64 12	61 48	58 48	55 48	53 24	51 00	48 36	46 12	43 48	41 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.17	1.12	1.07	1.03	0.98	0.93	0.89	0.85	0.81	0.77	0.73	0.69	$\triangle_1 h$
Log.	0.068 19	0.049 22	0.029 38	0.012 84	9.991 23	9.968 48	9.949 39	9.929 42	9.908 49	9.886 49	9.863 32	9.838 85	Log.
Limit	65	67	69	71	72	75	77	79	81	83	85	87	Minutes
Meridian	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	Altitudes

Latitude 3° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	5 59	5 00	4 17	3 44	3 19	2 59	2 43	2 29	2 17	2 07	4
8	...	...	23 59	20 00	17 07	14 59	13 19	11 58	10 51	9 56	9 09	8 29	8
12	...	...	...	...	38 31	33 42	29 56	26 54	24 26	22 20	20 36	19 07	12
16	...	...	...	...	...	...	...	...	43 26	39 44	36 36	33 57	16
20	...	...	...	...	...	...	...	...	...	...	57 12	53 04	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	22.48	18.74	16.05	14.04	12.47	11.21	10.18	9.31	8.58	7.96	$\triangle_1 h$
Log.	... ...	... ...	1.351 80	1.272 77	1.205 48	1.147 37	1.095 87	1.049 61	1.007 75	0.968 95	0.933 49	0.900 91	Log.
Limit	4	5	6	8	10	11	12	13	14	15	16	17	Minutes
Meridian	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 58	1 50	1 44	1 38	1 32	1 27	1 23	1 19	1 15	1 12	1 09	1 06	4
8	7 55	7 23	6 57	6 32	6 11	5 51	5 33	5 16	5 02	4 48	4 35	4 23	8
12	17 47	16 38	15 37	14 42	13 54	13 10	12 29	11 53	11 20	10 48	10 19	9 53	12
16	31 37	29 34	27 47	26 10	24 42	23 22	22 11	21 07	20 08	19 12	18 21	17 35	16
20	49 24	46 12	43 24	40 52	38 36	36 32	34 40	33 00	31 28	30 00	28 40	27 28	20
24	...	66 31	62 30	58 51	55 35	52 36	49 55	47 31	45 19	43 12	41 17	39 34	24
28	...	...	...	80 06	75 40	71 37	67 57	64 41	61 41	58 48	56 11	53 50	28
32	...	...	...	...	...	...	...	...	80 33	76 48	73 23	70 18	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	7.41	6.93	6.51	6.13	5.79	5.48	5.20	4.95	4.72	4.50	4.30	4.12	$\triangle_1 h$
Log.	0.869 82	0.840 73	0.813 58	0.787 46	0.762 68	0.738 78	0.716 00	0.694 61	0.673 94	0.653 21	0.633 47	0.614 90	Log.
Limit	18	19	20	21	22	23	24	25	26	27	28	29	Minutes
Meridian	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	Altitudes

Latitude 3° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 03	1 00	0 59	0 55	0 54	0 52	0 50	0 48	0 46	0 45	0 43	0 42	4
8	4 12	4 03	3 53	3 44	3 35	3 28	3 19	3 13	3 05	2 59	2 53	2 47	8
12	9 29	9 06	8 44	8 23	8 04	7 47	7 29	7 13	6 58	6 43	6 29	6 15	12
16	16 51	16 10	15 32	14 53	14 20	13 49	13 19	12 51	12 22	11 57	11 31	11 09	16
20	26 20	25 16	24 16	23 16	22 24	21 36	20 48	20 04	19 20	18 40	18 00	17 24	20
24	37 55	36 23	34 57	33 30	32 16	31 06	29 58	28 54	27 50	26 53	25 55	25 04	24
28	51 37	49 32	47 33	45 37	43 54	42 20	40 46	39 20	37 54	36 35	35 17	34 06	28
32	67 25	64 41	62 07	59 34	57 20	55 18	53 14	51 22	49 30	47 47	46 05	44 32	32
36	...	...	78 38	75 23	72 35	69 59	67 24	65 01	62 38	60 29	58 19	56 23	36
40	...	...	...	...	89 36	86 24	83 12	80 16	77 20	74 40	72 00	69 36	40
44	...	...	...	...	...	...	...	...	...	...	87 07	84 13	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.95	3.79	3.64	3.49	3.36	3.24	3.12	3.01	2.90	2.80	2.70	2.61	$\triangle_1 h$
Log.	0.596 60	0.578 64	0.561 10	0.542 83	0.526 34	0.510 55	0.494 15	0.478 57	0.462 40	0.447 16	0.431 36	0.416 64	Log.
Limit	30	31	31	32	33	34	36	36	37	38	39	39	Minutes
Meridian.	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 40	0 39	0 38	0 36	0 35	0 34	0 33	0 31	0 30	0 30	0 29	0 28	4
8	2 41	2 37	2 31	2 26	2 21	2 16	2 12	2 07	2 03	2 00	1 55	1 52	8
12	6 03	5 52	5 40	5 29	5 17	5 06	4 57	4 47	4 38	4 29	4 19	4 12	12
16	10 45	10 24	10 04	9 43	9 23	9 06	8 47	8 29	8 14	7 59	7 41	7 28	16
20	16 48	16 16	15 44	15 12	14 40	14 12	13 44	13 16	12 52	12 28	12 00	11 40	20
24	24 12	23 25	22 40	21 53	21 07	20 27	19 47	19 06	18 31	17 57	17 17	16 48	24
28	32 56	31 53	30 50	29 48	28 45	27 50	26 55	26 01	25 14	24 26	23 31	22 52	28
32	43 00	41 39	40 16	38 55	37 33	36 21	35 09	33 58	32 57	31 55	30 43	29 52	32
36	54 26	52 42	50 59	49 15	47 31	46 01	44 30	42 59	41 41	40 24	38 53	37 48	36
40	67 12	65 04	62 56	60 48	58 40	56 48	54 56	53 04	51 28	49 52	48 00	46 40	40
44	81 19	78 43	76 09	73 34	70 59	68 44	66 28	64 12	62 16	60 21	58 05	56 28	44
48	...	93 42	90 37	87 33	84 29	81 46	79 06	76 25	74 07	71 48	69 07	67 10	48
52	...	...	106 21	102 45	99 09	95 59	92 50	89 41	86 59	84 16	81 07	78 52	52
56	...	...	...	...	...	...	...	104 01	100 52	97 45	94 05	91 28	56
60	...	...	...	...	...	...	...	...	...	112 12	108 00	105 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.52	2.44	2.36	2.28	2.20	2.13	2.06	1.99	1.93	1.87	1.80	1.75	$\triangle_1 h$
Log.	0.410 40	0.387 39	0.372 91	0.357 93	0.342 42	0.328 38	0.313 87	0.298 85	0.285 56	0.271 84	0.255 27	0.243 04	Log.
Limit	40	41	42	43	43	44	45	46	47	48	49	50	Minutes
Meridian	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 26	0 25	0 24	0 23	0 22	0 22	0 21	0 20	0 19	0 19	0 19	4
8	1 48	1 44	1 41	1 37	1 34	1 31	1 28	1 24	1 22	1 19	1 16	1 13	8
12	4 03	3 54	3 48	3 39	3 32	3 25	3 17	3 10	3 05	2 57	2 51	2 44	12
16	7 13	6 58	6 44	6 39	6 16	6 03	5 51	5 38	5 27	5 15	5 05	4 52	16
20	11 16	10 52	10 32	10 08	9 48	9 28	9 08	8 48	8 32	8 12	7 56	7 36	20
24	16 14	15 39	15 10	14 36	14 06	13 38	13 09	12 41	12 17	11 48	11 26	10 57	24
28	22 05	21 18	20 39	19 52	19 13	18 34	17 54	17 15	16 44	16 05	15 33	14 53	28
32	28 50	27 49	26 58	25 56	25 06	24 14	23 23	22 31	21 51	21 00	20 18	19 27	32
36	36 31	35 13	34 08	32 50	31 45	30 40	29 36	28 31	27 39	26 34	25 43	24 38	36
40	45 04	43 28	42 08	40 32	39 12	37 52	36 32	35 12	34 08	32 48	31 44	30 24	40
44	54 32	52 36	50 59	49 03	47 26	45 49	44 13	42 36	41 18	39 41	38 24	36 47	44
48	64 53	62 35	60 40	58 22	56 27	54 22	52 36	50 41	49 09	47 14	45 41	43 46	48
52	76 09	73 27	71 12	68 30	66 15	64 00	61 44	59 29	57 41	55 26	53 37	51 22	52
56	88 20	85 12	82 35	79 27	76 50	74 13	71 37	69 00	66 54	64 17	62 12	59 35	56
60	101 24	97 48	94 48	91 12	88 12	85 12	82 12	79 12	76 48	73 48	71 24	68 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.69	1.63	1.58	1.52	1.47	1.42	1.37	1.32	1.28	1.23	1.19	1.14	$\triangle_1 h$
Log.	0.227 89	0.212 19	0.198 66	0.181 84	0.167 32	0.152 29	0.136 72	0.120 57	0.107 21	0.089 91	0.075 55	0.056 90	Log.
Limit	51	52	54	55	56	57	59	61	62	65	67	69	Minutes
Meridian	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 17	0 16	0 15	0 14	0 14	0 14	0 13	0 12	0 12	0 11	0 11	4
8	1 10	1 08	1 05	1 02	0 59	0 57	0 54	0 51	0 50	0 47	0 45	0 42	8
12	2 38	2 33	2 27	2 20	2 14	2 08	2 02	1 56	1 52	1 47	1 41	1 35	12
16	4 42	4 31	4 21	4 08	3 58	3 48	3 38	3 28	3 19	3 09	2 59	2 49	16
20	7 20	7 04	6 48	6 28	6 12	5 56	5 40	5 24	5 12	4 56	4 40	4 24	20
24	10 34	10 11	9 48	9 18	8 55	8 33	8 10	7 47	7 29	7 06	6 43	6 21	24
28	14 22	13 51	13 20	12 41	12 10	11 38	11 06	10 35	10 12	9 40	9 09	8 37	28
32	18 46	18 05	17 24	16 34	15 53	15 11	14 30	13 49	13 19	12 38	11 57	11 15	32
36	23 46	22 54	22 02	20 57	20 05	19 14	18 22	17 30	16 51	15 59	15 07	14 16	36
40	29 20	28 16	27 12	25 52	24 48	23 44	22 40	21 36	20 48	19 44	18 40	17 36	40
44	35 30	34 12	32 55	31 18	30 00	28 43	27 26	26 08	25 10	23 52	22 35	21 18	44
48	42 14	40 42	39 10	37 15	35 43	34 10	32 38	31 06	29 55	28 23	26 51	25 20	48
52	49 34	47 46	45 58	43 43	41 55	40 06	38 18	36 30	35 09	33 21	31 33	29 44	52
56	57 30	55 24	53 19	50 42	48 36	46 31	44 26	42 20	40 46	38 40	36 35	34 30	56
60	66 00	63 36	61 12	58 12	55 48	53 24	51 00	48 36	46 48	44 24	42 00	39 36	60
	″	″		″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.10	1.06	1.02	0.97	0.93	0.89	0.85	0.81	0.78	0.74	0.70	0.66	$\triangle_1 h$
Log.	0.041 39	0.025 31	0.008 60	0.986 77	9.968 48	9.949 39	9.929 42	9.908 49	9.892 09	9.869 23	9.845 10	9.819 54	Log.
Limit	70	71	73	75	77	78	81	83	85	87	90	93	Minutes
Meridian	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	Altitudes

Latitude 4° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	' "	' "	' "	' "	' "	' "	' "	' "	' "	' "	' "	' "	Min.
4	...	...	...	...	...	...	...	...	...	5 55	4 55	4 12	4
8	...	...	...	...	...	...	...	...	...	23 41	19 41	16 50	8
12	...	...	...	...	...	...	...	...	...	...	...	37 53	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	"	"	"	"	"	"	"	"	"	"	"	"	
$\triangle_1$h	...	...	...	...	...	...	...	...	...	22.20	18.45	15.78	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.346 35	1.266 00	1.198 11	Log.
Limit	5	4	2	1	0	2	3	5	7	8	9	10	Minutes
Meridian	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	' "	' "	' "	' "	' "	' "	' "	' "	' "	' "	' "	' "	Min.
4	3 40	3 15	2 55	2 38	2 25	2 13	2 03	1 55	1 47	1 40	1 34	1 29	4
8	14 42	13 01	11 40	10 34	9 40	8 53	8 13	7 38	7 07	6 40	6 16	5 55	8
12	33 03	29 17	26 16	23 49	21 45	19 59	18 29	17 11	16 02	15 00	14 07	13 18	12
16	...	...	46 40	42 19	38 39	35 33	32 51	30 33	28 30	26 40	25 05	23 38	16
20	...	...	...	...	...	55 32	51 20	47 44	44 32	42 40	39 12	36 56	20
24	...	...	...	...	...	...	...	...	64 08	60 00	56 27	53 11	24
28	...	...	...	...	...	...	...	...	...	81 40	76 50	72 23	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	"	"	"	"	"	"	"	"	"	"	"	"	
$\triangle_1$h	13.77	12.20	10.94	9.92	9.06	8.33	7.70	7.16	6.68	6.25	5.88	5.54	$\triangle_1$h
Log.	1.138 93	1.086 36	1.039 02	0.996 51	0.957 13	0.920 65	0.886 49	0.854 91	0.824 78	0.795 88	0.769 38	0.743 51	Log.
Limit	11	12	13	15	16	17	18	19	20	21	22	23	Minutes
Meridian	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 23	1 19	1 15	1 11	1 08	1 05	1 02	0 59	0 57	0 54	0 52	0 50	4
8	5 35	5 16	5 01	4 47	4 32	4 19	4 08	3 57	3 47	3 37	3 28	3 19	8
12	12 33	11 53	11 17	10 44	10 12	9 43	9 17	8 53	8 30	8 08	7 48	7 29	12
16	22 19	21 07	20 03	19 04	18 08	17 17	16 31	15 47	15 06	14 28	13 52	13 19	16
20	34 52	33 00	31 20	29 48	28 20	27 00	25 48	24 40	23 36	22 36	21 40	20 48	20
24	50 12	47 31	45 07	42 53	40 48	38 53	37 09	35 31	33 59	32 33	31 12	29 58	24
28	68 21	64 41	61 25	58 25	55 32	52 55	50 34	48 21	46 15	44 18	42 28	40 46	28
32	...	...	80 13	76 18	72 32	69 07	66 03	63 09	60 25	57 51	55 28	53 14	32
36	...	...	...	...	...	...	...	79 55	76 28	73 14	70 12	67 24	36
40	...	...	...	...	...	...	...	...	...	90 24	86 40	83 12	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	5.23	4.95	4.70	4.47	4.25	4.05	3.87	3.70	3.54	3.39	3.25	3.12	Δ_1h
Log.	0.718 50	0.694 61	0.672 10	0.650 31	0.628 39	0.607 46	0.587 71	0.568 20	0.549 00	0.530 20	0.511 88	0.494 15	Log.
Limit	24	25	26	27	28	29	30	31	32	33	34	35	Minutes
Meridian	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 47	0 46	0 44	0 43	0 41	0 39	0 38	0 36	0 35	0 34	0 32	0 31	4
8	3 11	3 04	2 57	2 49	2 43	2 38	2 31	2 26	2 20	2 15	2 10	2 05	8
12	7 11	6 53	6 38	6 21	6 07	5 55	5 40	5 29	5 15	5 03	4 52	4 43	12
16	12 45	12 15	11 46	11 19	10 53	10 29	10 04	9 43	9 21	9 01	8 40	8 21	16
20	19 56	19 08	18 24	17 40	17 00	16 24	15 44	15 12	14 36	14 04	13 32	13 04	20
24	28 42	27 33	26 30	25 27	24 29	23 37	22 40	21 53	21 02	20 16	19 29	18 49	24
28	39 05	37 30	36 04	34 37	33 19	32 09	30 50	29 48	28 37	27 34	26 32	25 37	28
32	51 02	48 59	47 06	45 13	43 31	41 59	40 16	38 55	37 22	36 00	34 39	33 27	32
36	64 35	62 00	59 37	57 15	55 05	53 08	50 59	49 15	47 19	45 35	43 51	42 20	36
40	79 44	76 32	73 36	70 40	68 00	65 36	62 56	60 48	58 24	56 16	54 08	52 16	40
44	...	...	...	85 31	82 17	79 22	76 09	73 34	70 40	68 05	65 30	63 14	44
48	...	...	...	...	...	94 28	90 37	87 33	84 05	81 01	77 57	75 16	48
52	...	...	...	...	...	...	106 21	102 45	98 41	95 05	91 29	88 20	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	2.99	2.87	2.76	2.65	2.55	2.46	2.36	2.28	2.19	2.11	2.03	1.96	Δ_1h
Log.	0.475 67	0.457 88	0.440 91	0.423 25	0.406 54	0.390 94	0.372 91	0.357 93	0.340 44	0.324 28	0.307 50	0.292 26	Log.
Limit	36	37	38	39	40	41	42	43	44	44	45	46	Minutes
Meridian	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	Altitudes

Latitude 4° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 29	0 28	0 27	0 26	0 25	0 24	0 23	0 22	0 22	0 20	0 19	4
8	2 01	1 56	1 52	1 48	1 43	1 40	1 36	1 33	1 29	1 26	1 22	1 19	8
12	4 32	4 22	4 12	4 03	3 53	3 45	3 36	3 29	3 20	3 13	3 05	2 57	12
16	8 04	7 46	7 28	7 13	6 55	6 39	6 24	6 11	5 56	5 43	5 27	5 15	16
20	12 36	12 08	11 40	11 16	10 48	10 24	10 00	9 40	9 16	8 56	8 32	8 12	20
24	18 09	17 29	16 48	16 14	15 34	14 59	14 24	13 55	13 21	12 52	12 17	11 48	24
28	24 42	23 47	22 52	22 05	21 10	20 23	19 36	18 57	18 10	17 30	16 44	16 05	28
32	32 15	31 03	29 52	28 50	27 38	26 37	25 36	24 45	23 43	22 52	21 51	21 00	32
36	40 50	39 19	37 48	36 31	35 00	33 42	32 24	31 19	30 02	28 57	27 39	26 34	36
40	50 24	48 32	46 40	45 04	43 12	41 36	40 00	38 40	37 04	35 44	34 08	32 48	40
44	60 59	58 44	56 28	54 32	52 17	50 20	48 24	46 47	44 51	43 14	41 18	39 41	44
48	72 34	69 53	67 10	64 53	62 12	59 54	57 36	55 41	53 22	51 27	49 09	47 14	48
52	85 10	82 01	78 52	76 09	73 00	70 18	67 36	65 21	62 38	60 23	57 41	55 26	52
56	98 47	95 08	91 28	88 20	84 41	81 32	78 24	75 37	72 39	70 02	66 54	64 17	56
60	113 24	109 12	105 00	101 24	97 12	93 36	90 00	87 00	83 24	80 24	76 48	73 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.89	1.82	1.75	1.69	1.62	1.56	1.50	1.45	1.39	1.34	1.28	1.23	$\triangle_1 h$
Log.	0.276 46	0.260 07	0.243 04	0.227 89	0.209 52	0.193 12	0.176 09	0.161 37	0.143 01	0.127 10	0.107 21	0.089 91	Log.
Limit	47	48	49	50	51	53	55	56	57	58	60	62	Minutes
Meridian	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 18	0 17	0 17	0 15	0 15	0 14	0 14	0 13	0 12	0 11	0 11	4
8	1 15	1 12	1 09	1 07	1 03	1 00	0 57	0 55	0 52	0 50	0 47	0 44	8
12	2 50	2 42	2 36	2 30	2 23	2 16	2 10	2 04	1 58	1 51	1 45	1 39	12
16	5 02	4 50	4 36	4 26	4 13	4 00	3 50	3 40	3 30	3 17	3 07	2 57	16
20	7 52	7 32	7 12	6 56	6 36	6 16	6 00	5 44	5 28	5 08	4 52	4 36	20
24	11 20	10 51	10 22	9 59	9 30	9 01	8 38	8 16	7 53	7 23	7 00	6 38	24
28	15 25	14 46	14 07	13 35	12 57	12 17	11 46	11 14	10 43	10 04	9 33	9 01	28
32	20 08	19 17	18 26	17 45	16 54	16 03	15 22	14 40	13 59	13 09	12 28	11 46	32
36	25 30	24 25	23 20	22 28	21 23	20 18	19 26	18 35	17 43	16 38	15 46	14 55	36
40	31 28	30 08	28 48	27 44	26 24	25 04	24 00	22 56	21 52	20 32	19 28	18 24	40
44	38 05	36 28	34 51	33 33	31 56	30 19	29 02	27 45	26 28	24 51	23 33	22 16	44
48	45 18	43 23	41 28	39 56	38 01	36 06	34 34	33 01	31 29	29 32	28 00	26 29	48
52	53 10	50 55	48 40	46 52	44 37	42 22	40 34	38 45	36 57	34 42	32 54	31 05	52
56	61 41	59 04	56 27	54 21	51 44	49 07	47 02	44 57	42 52	40 15	38 09	36 04	56
60	70 48	67 48	64 48	62 24	59 24	56 24	54 00	51 36	49 12	46 12	43 48	41 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.18	1.13	1.08	1.04	0.99	0.94	0.90	0.86	0.82	0.77	0.73	0.69	$\triangle_1 h$
Log.	0.071 88	0.053 08	0.033 42	0.017 03	9.995 64	9.973 13	9.954 24	9.934 50	9.913 81	9.886 49	9.863 32	9.838 85	Log.
Limit	64	66	68	70	72	74	76	78	80	82	84	86	Minutes
Meridian	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	Altitudes

Latitude 4° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	5 59	5 00	4 17	3 45	3 19	2 59	2 43	2 29	2 18	2 07	1 58	4
8	...	23 59	19 59	17 07	14 59	13 19	11 58	10 52	9 57	9 10	8 30	7 56	8
12	...	...	...	38 31	33 42	29 56	26 56	24 27	22 23	20 38	19 08	17 50	12
16	...	...	...	...	...	...	...	43 29	39 49	36 42	34 00	31 42	16
20	...	...	...	...	...	...	...	...	...	57 20	53 08	49 32	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	22.47	18.73	16.05	14.04	12.47	11.22	10.19	9.33	8.60	7.97	7.43	$\triangle_1 h$
Log.	... ...	1.351 60	1.272 54	1.205 48	1.147 37	1.095 87	1.049 99	1.008 17	0.969 88	0.934 50	0.901 46	0.870 99	Log.
Limit	6	7	8	9	11	12	13	14	15	16	17	18	Minutes
Meridian	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 51	1 44	1 39	1 33	1 28	1 23	1 19	1 16	1 12	1 09	1 07	1 03	4
8	7 24	6 58	6 33	6 12	5 53	5 35	5 18	5 04	4 50	4 37	4 25	4 14	8
12	16 41	15 40	14 45	13 56	13 13	12 33	11 56	11 23	10 52	10 23	9 56	9 32	12
16	29 39	27 52	26 15	24 48	23 31	22 19	21 12	20 13	19 20	18 29	17 40	16 56	16
20	46 20	43 32	41 00	38 44	36 44	34 52	33 08	31 36	30 12	28 52	27 36	26 28	20
24	66 43	62 41	59 03	55 47	52 54	50 12	47 42	45 30	43 29	41 34	39 45	38 06	24
28	...	...	80 21	75 55	72 00	68 21	64 57	61 54	59 12	56 35	54 05	51 53	28
32	...	...	...	...	...	...	...	80 54	77 19	73 53	70 39	67 46	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.95	6.53	6.15	5.81	5.51	5.23	4.97	4.74	4.53	4.33	4.14	3.97	$\triangle_1 h$
Log.	0.841 98	0.814 91	0.788 88	0.764 18	0.741 15	0.718 50	0.696 36	0.675 78	0.656 10	0.636 49	0.617 00	0.598 79	Log.
Limit	19	20	21	22	23	24	25	26	27	28	29	30	Minutes
Meridian	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	Altitudes

Latitude 4° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 01	0 59	0 56	0 54	0 52	0 51	0 48	0 46	0 45	0 43	0 43	0 41	4
8	4 04	3 54	3 45	3 37	3 29	3 21	3 14	3 07	3 01	2 55	2 49	2 43	8
12	9 08	8 47	8 27	8 08	7 50	7 33	7 16	7 02	6 47	6 33	6 20	6 07	12
16	16 16	15 37	15 01	14 28	13 54	13 27	12 56	12 30	12 05	11 39	11 16	10 53	16
20	25 24	24 24	23 28	22 36	21 44	21 00	20 12	19 32	18 52	18 12	17 36	17 00	20
24	36 35	35 09	33 48	32 33	31 18	30 15	29 05	28 07	27 10	26 12	25 21	24 29	24
28	49 47	47 49	46 00	44 18	42 36	41 09	39 36	38 18	36 59	35 41	34 29	33 19	28
32	65 01	62 27	60 04	57 51	55 38	53 45	51 43	50 01	48 18	46 36	45 03	43 31	32
36	...	79 04	76 02	73 14	70 25	68 03	65 27	63 17	61 08	58 58	57 02	55 05	36
40	...	...	...	90 24	86 56	84 00	80 48	78 08	75 28	72 48	70 24	68 00	40
44	...	...	...	...	...	...	...	...	...	88 05	85 11	82 17	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.81	3.66	3.52	3.39	3.26	3.15	3.03	2.93	2.83	2.73	2.64	2.55	$\triangle_1 h$
Log.	0.580 92	0.563 48	0.546 54	0.530 20	0.513 22	0.498 31	0.481 44	0.466 87	0.451 79	0.436 16	0.421 60	0.406 54	Log.
Limit	31	31	32	33	34	35	36	37	38	39	40	40	Minutes
Meridian	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 39	0 38	0 37	0 35	0 35	0 33	0 32	0 31	0 30	0 30	0 28	0 27	4
8	2 39	2 32	2 28	2 23	2 18	2 14	2 09	2 05	2 01	1 58	1 54	1 50	8
12	5 56	5 43	5 32	5 21	5 11	5 01	4 51	4 43	4 34	4 25	4 17	4 08	12
16	10 32	10 09	9 52	9 31	9 13	8 55	8 37	8 21	8 06	7 51	7 35	7 20	16
20	16 28	15 52	15 24	14 52	14 24	13 56	13 28	13 04	12 40	12 16	11 52	11 28	20
24	23 42	22 51	22 11	21 24	20 45	20 04	19 24	18 49	18 14	17 40	17 05	16 31	24
28	32 17	31 06	30 11	29 09	28 13	27 19	26 24	25 37	24 50	24 02	23 16	22 29	28
32	42 10	40 37	39 25	38 04	36 51	35 40	34 28	33 27	32 26	31 24	30 23	29 21	32
36	53 21	51 25	49 54	48 10	46 40	45 09	43 38	42 20	41 02	39 45	38 27	37 09	36
40	65 52	63 28	61 36	59 28	57 36	55 44	53 52	52 16	50 40	49 04	47 28	45 52	40
44	79 42	76 48	74 32	71 57	69 42	67 26	65 11	63 14	61 18	59 22	57 26	55 30	44
48	94 51	91 23	88 42	85 38	82 56	80 15	77 34	75 16	72 58	70 39	68 19	66 01	48
52	...	107 15	104 06	100 30	97 20	94 11	91 02	88 20	85 38	82 55	80 13	77 31	52
56	...	...	...	...	...	...	...	...	99 18	96 10	93 02	89 54	56
60	...	...	...	...	...	...	...	...	...	...	106 48	103 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.47	2.38	2.31	2.23	2.16	2.09	2.02	1.96	1.90	1.84	1.78	1.72	$\triangle_1 h$
Log.	0.392 70	0.376 58	0.363 61	0.348 30	0.334 45	0.320 15	0.305 35	0.292 26	0.278 75	0.264 82	0.250 42	0.235 53	Log.
Limit	41	42	43	44	44	45	46	47	48	49	50	51	Minutes
Meridian	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	Altitudes

Latitude 4° Declination Contrary Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 26	0 25	0 24	0 23	0 22	0 22	0 21	0 20	0 19	0 19	0 18	4
8	1 46	1 42	1 40	1 36	1 33	1 30	1 27	1 23	1 21	1 18	1 15	1 12	8
12	3 59	3 51	3 45	3 36	3 29	3 23	3 16	3 08	3 02	2 56	2 50	2 42	12
16	7 05	6 53	6 39	6 24	6 11	6 01	5 48	5 36	5 22	5 12	5 02	4 50	16
20	11 04	10 44	10 24	10 00	9 40	9 24	9 04	8 44	8 24	8 08	7 52	7 32	20
24	15 57	15 28	14 59	14 24	13 55	13 32	13 04	12 35	12 06	11 43	11 20	10 51	24
28	21 41	21 02	20 23	19 36	18 57	18 26	17 46	17 07	16 28	15 57	15 25	14 46	28
32	28 19	27 28	26 37	25 36	24 45	24 04	23 12	22 21	21 30	20 49	20 08	19 17	32
36	35 52	34 47	33 42	32 24	31 19	30 27	29 23	28 18	27 13	26 21	25 30	24 25	36
40	44 16	42 56	41 36	40 00	38 40	37 36	36 16	34 56	33 36	32 32	31 28	30 08	40
44	53 34	51 57	50 20	48 24	46 47	45 29	43 53	42 16	40 39	39 22	38 05	36 28	44
48	63 44	61 49	59 54	57 36	55 41	54 09	52 13	50 18	48 23	46 51	45 18	43 23	48
52	74 48	72 33	70 18	67 36	65 21	63 33	61 17	59 02	56 47	54 29	53 10	55 55	52
56	86 46	84 09	81 32	78 24	75 37	73 41	71 05	68 28	65 51	63 46	61 41	59 04	56
60	99 36	96 36	93 36	90 00	87 00	84 36	81 36	78 36	75 36	73 12	70 48	67 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.66	1.61	1.56	1.50	1.45	1.41	1.36	1.31	1.26	1.22	1.18	1.13	$\triangle_1 h$
Log.	0.220 11	0.206 83	0.193 12	0.176 09	0.161 37	0.149 22	0.133 54	0.117 27	0.100 37	0.086 36	0.071 88	0.053 08	Log.
Limit	52	53	55	56	57	58	60	62	63	65	67	68	Minutes
Meridian	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 16	0 15	0 14	0 14	0 14	0 13	0 12	0 11	0 11	0 11	4
8	1 10	1 07	1 04	1 02	0 59	0 57	0 54	0 51	0 50	0 47	0 45	0 42	8
12	2 37	2 31	2 25	2 20	2 14	2 08	2 02	1 56	1 51	1 45	1 41	1 36	12
16	4 39	4 29	4 19	4 08	3 58	3 48	3 38	3 28	3 17	3 07	2 59	2 52	16
20	7 16	7 00	6 44	6 28	6 12	5 56	5 40	5 24	5 08	4 52	4 40	4 28	20
24	10 28	10 05	9 42	9 18	8 55	8 33	8 10	7 47	7 23	7 00	6 43	6 26	24
28	14 15	13 43	13 12	12 41	12 10	11 38	11 06	10 35	10 04	9 33	9 09	8 45	28
32	18 36	17 55	17 14	16 34	15 53	15 11	14 30	13 49	13 09	12 28	11 57	11 26	32
36	23 33	22 41	21 49	20 57	20 05	19 14	18 22	17 30	16 38	15 46	15 07	14 29	36
40	29 04	28 00	26 56	25 52	24 48	23 44	22 40	21 36	20 32	19 28	18 40	17 52	40
44	35 10	33 53	32 35	31 18	30 00	28 43	27 26	26 08	24 51	23 33	22 35	21 38	44
48	41 51	40 19	38 47	37 15	35 43	34 10	32 38	31 06	29 32	28 00	26 51	25 43	48
52	49 07	47 19	45 31	43 43	41 55	40 06	38 18	36 30	34 42	32 54	31 33	30 11	52
56	56 58	54 53	52 47	50 42	48 36	46 31	44 26	42 20	40 15	38 09	36 35	35 02	56
60	65 24	63 00	60 36	58 12	55 48	53 24	51 00	48 36	46 12	43 48	42 00	40 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.09	1.05	1.01	0.97	0.93	0.89	0.85	0.81	0.77	0.73	0.70	0.67	$\triangle_1 h$
Log.	0.037 43	0.021 19	0.004 32	9.986 77	9.968 48	9.949 39	9.929 42	9.908 49	9.886 49	9.863 32	9.845 10	9.826 07	Log.
Limit	70	72	74	76	77	79	81	83	85	87	90	93	Minutes
Meridian	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	Altitudes

Latitude 5° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	5 59	...	...	...	...	...	...	...	...	...	5 54	4 54	4
8	23 57	...	...	...	...	...	...	...	...	...	23 34	19 36	8
12	...	...	...	...	...	...	...	...	...	...	...	...	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	22.44	...	...	...	...	...	...	...	...	...	22.10	18.37	$\triangle_1$h
Log.	1.351 02	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.344 39	1.264 11	Log.
Limit	6	4	3	2	1	0	1	3	5	7	8	9	Minutes
Meridian	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	4 11	3 39	3 15	2 54	2 38	2 24	2 12	2 03	1 54	1 46	1 39	1 33	4
8	16 45	14 36	12 56	11 36	10 30	9 36	8 50	8 09	7 34	7 04	6 37	6 13	8
12	37 41	32 51	29 06	26 06	23 38	21 36	19 51	18 20	17 02	15 54	14 53	13 59	12
16	...	...	...	46 25	42 02	38 24	35 17	32 36	30 18	28 18	26 27	24 53	16
20	...	...	...	...	...	...	55 08	50 56	47 20	44 12	41 20	38 52	20
24	...	...	...	...	...	...	...	...	...	63 39	59 31	55 58	24
28	...	...	...	...	...	...	...	...	...	...	81 01	76 11	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	15.70	13.69	12.13	10.88	9.85	9.00	8.27	7.64	7.10	6.63	6.20	5.83	$\triangle_1$h
Log.	1.195 90	1.136 40	1.083 86	1.036 63	0.993 44	0.954 24	0.917 51	0.883 09	0.851 26	0.821 51	0.792 39	0.765 67	Log.
Limit	10	11	13	14	15	16	17	18	19	20	21	22	Minutes
Meridian	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	Altitudes

Latitude 5° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 27	1 23	1 18	1 15	1 10	1 07	1 04	1 01	0 59	0 55	0 54	0 51	4
8	5 52	5 31	5 14	4 57	4 43	4 30	4 17	4 05	3 53	3 44	3 34	3 25	8
12	13 11	12 26	11 47	11 09	10 37	10 06	9 37	9 10	8 45	8 23	8 01	7 41	12
16	23 25	22 06	20 57	19 51	18 51	17 58	17 07	16 18	15 35	14 53	14 15	13 39	16
20	36 36	34 32	32 44	31 00	29 28	28 04	26 44	25 28	24 20	23 16	22 16	21 20	20
24	52 42	49 44	47 08	44 39	42 26	40 25	38 30	36 41	35 03	33 30	32 04	30 43	24
28	71 45	67 41	64 10	60 45	57 46	55 01	52 24	49 55	47 41	45 37	43 38	41 49	28
32	...	...	...	79 21	75 26	71 51	68 26	65 11	62 17	59 34	57 00	54 37	32
36	...	...	...	...	...	...	...	...	78 51	75 23	72 09	69 07	36
40	...	...	...	...	...	...	...	...	...	...	89 04	85 20	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.49	5.18	4.91	4.65	4.42	4.21	4.01	3.82	3.65	3.49	3.34	3.20	$\triangle_1 h$
Log.	0.739 57	0.714 33	0.691 08	0.667 45	0.645 42	0.624 28	0.603 14	0.582 06	0.562 29	0.542 83	0.523 75	0.505 15	Log.
Limit	23	24	25	26	27	28	29	30	31	32	33	34	Minutes
Meridian	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 49	0 47	0 45	0 43	0 42	0 40	0 38	0 37	0 36	0 35	0 33	0 31	4
8	3 17	3 09	3 01	2 54	2 47	2 41	2 35	2 28	2 24	2 17	2 13	2 07	8
12	7 22	7 05	6 47	6 32	6 15	6 01	5 49	5 34	5 23	5 09	4 58	4 47	12
16	13 06	12 35	12 05	11 36	11 09	10 43	10 19	9 54	9 33	9 11	8 50	8 29	16
20	20 28	19 40	18 52	18 08	17 24	16 44	16 08	15 28	14 56	14 20	13 48	13 16	20
24	29 28	28 19	27 10	26 07	25 04	24 06	23 14	22 17	21 30	20 39	19 52	19 06	24
28	40 07	38 33	36 59	35 33	34 06	32 48	31 38	30 19	29 16	28 05	27 03	26 01	28
32	52 24	50 21	48 18	46 25	44 32	42 50	41 18	39 35	38 14	36 41	35 20	33 58	32
36	66 19	63 43	61 08	58 45	56 23	54 13	52 16	50 07	48 23	46 27	44 43	42 59	36
40	81 52	78 40	75 28	72 32	69 36	66 56	64 32	61 52	59 44	57 20	55 12	53 04	40
44	...	...	...	87 46	84 13	80 59	78 05	74 52	72 16	69 23	66 48	64 12	44
48	...	...	...	...	...	96 23	92 56	89 05	86 01	82 33	79 29	76 25	48
52	...	...	...	...	...	...	...	104 33	100 57	96 53	93 17	89 41	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.07	2.95	2.83	2.72	2.61	2.51	2.42	2.32	2.24	2.15	2.07	1.99	$\triangle_1 h$
Log.	0.487 14	0.469 82	0.451 79	0.434 57	0.416 64	0.399 67	0.383 82	0.365 49	0.350 25	0.332 44	0.315 97	0.298 85	Log.
Limit	35	36	37	38	39	40	41	42	43	43	44	45	Minutes
Meridian	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	Altitudes

Latitude 5° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 30	0 28	0 27	0 27	0 25	0 24	0 23	0 22	0 22	0 21	0 20	4
8	2 02	1 58	1 54	1 50	1 45	1 41	1 37	1 34	1 30	1 26	1 23	1 20	8
12	4 37	4 26	4 17	4 06	3 57	3 48	3 39	3 31	3 23	3 14	3 07	3 00	12
16	8 11	7 54	7 35	7 18	7 03	6 44	6 29	6 13	6 01	5 46	5 33	5 20	16
20	12 48	12 20	11 52	11 24	11 00	10 32	10 08	9 44	9 24	9 00	8 40	8 20	20
24	18 26	17 46	17 05	16 25	15 51	15 10	14 36	14 01	13 32	12 58	12 29	12 00	24
28	25 06	24 10	23 16	22 21	21 33	20 39	19 52	19 05	18 26	17 38	16 59	16 20	28
32	32 46	31 34	30 23	29 11	28 09	26 58	25 56	24 55	24 04	23 02	22 11	21 20	32
36	41 28	39 58	38 27	36 56	35 39	34 08	32 50	31 32	30 27	29 10	28 05	27 00	36
40	51 12	49 20	47 28	45 36	44 00	42 08	40 32	38 56	37 36	36 00	34 40	33 20	40
44	61 57	59 42	57 26	55 10	53 15	50 59	49 03	47 06	45 29	43 34	41 57	40 20	44
48	73 44	71 02	68 19	65 38	63 21	60 40	58 22	56 04	54 09	51 50	49 55	48 00	48
52	86 32	83 22	80 13	77 04	74 21	71 12	68 30	65 48	63 33	60 50	58 35	56 20	52
56	100 21	96 42	93 02	89 22	86 15	82 35	79 27	76 18	73 41	70 34	67 57	65 20	56
60	...	111 00	106 48	102 36	99 00	94 48	91 12	87 36	84 36	81 00	78 00	75 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.92	1.85	1.78	1.71	1.65	1.58	1.52	1.46	1.41	1.35	1.30	1.25	$\triangle_1 h$
Log.	0.283 30	0.267 17	0.250 42	0.233 00	0.217 48	0.198 66	0.181 84	0.164 35	0.149 22	0.130 33	0.113 94	0.096 91	Log.
Limit	46	47	48	49	50	52	54	55	56	57	59	61	Minutes
Meridian	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 17	0 17	0 16	0 15	0 14	0 14	0 13	0 12	0 12	0 11	4
8	1 16	1 13	1 10	1 07	1 04	1 01	0 58	0 55	0 52	0 50	0 47	0 45	8
12	2 51	2 44	2 37	2 31	2 24	2 17	2 11	2 04	1 58	1 52	1 47	1 41	12
16	5 05	4 52	4 39	4 29	4 16	4 03	3 53	3 40	3 30	3 19	3 09	2 59	16
20	7 56	7 36	7 16	7 00	6 40	6 20	6 04	5 44	5 28	5 12	4 56	4 40	20
24	11 26	10 57	10 28	10 05	9 36	9 07	8 44	8 16	7 53	7 29	7 06	6 43	24
28	15 33	14 53	14 15	13 43	13 04	12 25	11 54	11 14	10 43	10 12	9 40	9 09	28
32	20 18	19 27	18 36	17 55	17 04	16 13	15 32	14 40	13 59	13 19	12 38	11 57	32
36	25 43	24 38	23 33	22 41	21 36	20 31	19 39	18 35	17 43	16 51	15 59	15 07	36
40	31 44	30 24	29 04	28 00	26 40	25 20	24 16	22 56	21 52	20 48	19 44	18 40	40
44	38 24	36 47	35 10	33 53	32 16	30 39	29 21	27 45	26 28	25 10	23 52	22 35	44
48	45 41	43 46	41 51	40 19	38 24	36 29	34 57	33 01	31 29	29 55	28 23	26 51	48
52	53 37	51 22	49 07	47 19	45 04	42 49	41 01	38 45	36 57	35 09	33 21	31 33	52
56	62 12	59 35	56 58	54 53	52 16	49 39	47 33	44 57	42 52	40 46	38 40	36 35	56
60	71 24	68 24	65 24	63 00	60 00	57 00	54 36	51 36	49 12	46 48	44 24	42 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.19	1.14	1.09	1.05	1.00	0.95	0.91	0.86	0.82	0.78	0.74	0.70	$\triangle_1 h$
Log.	0.075 55	0.056 90	0.037 43	0.021 19	0.00 ...	9.977 72	9.959 04	9.934 50	9.913 81	9.892 09	9.869 23	9.845 10	Log.
Limit	63	66	68	70	72	74	76	78	80	82	84	86	Minutes
Meridian	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	Altitudes

Latitude 5° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	5 59	4 59	4 17	3 45	3 18	2 59	2 43	2 29	2 18	2 07	1 59	1 51	4
8	23 57	19 58	17 07	14 59	13 19	11 57	10 53	9 58	9 11	8 31	7 57	7 26	8
12	...	...	38 30	33 42	29 56	26 56	24 29	22 25	20 39	19 11	17 52	16 44	12
16	...	...	...	...	...	...	43 31	39 51	36 45	34 05	31 44	29 44	16
20	...	...	...	...	...	...	...	...	57 24	53 16	49 36	46 28	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	22.44	18.71	16.04	14.04	12.47	11.22	10.20	9.34	8.61	7.99	7.44	6.97	$\triangle_1$h
Log.	1.351 02	1.272 07	1.205 20	1.147 37	1.095 87	1.049 99	1.008 60	0.970 35	0.935 00	0.902 55	0.871 57	0.843 23	Log.
Limit	7	8	10	11	12	13	14	15	16	17	18	19	Minutes
Meridian	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 45	1 39	1 33	1 28	1 24	1 19	1 16	1 13	1 10	1 07	1 03	1 02	4
8	6 59	6 35	6 13	5 53	5 36	5 19	5 05	4 51	4 38	4 27	4 15	4 06	8
12	15 42	14 48	13 59	13 15	12 36	11 59	11 26	10 55	10 26	10 00	9 35	9 13	12
16	27 54	26 20	24 53	23 33	22 24	21 17	20 18	19 25	18 34	17 48	17 01	16 23	16
20	43 36	41 08	38 52	36 48	35 00	33 16	31 44	30 20	29 00	27 48	26 36	25 36	20
24	62 47	59 14	55 58	53 00	50 24	47 54	45 42	43 41	41 46	40 02	38 18	36 52	24
28	...	80 37	76 11	72 08	68 36	65 11	62 10	59 27	56 50	54 29	52 09	50 10	28
32	...	...	...	...	...	...	81 14	77 39	74 14	71 10	68 06	65 32	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	6.54	6.17	5.83	5.52	5.25	4.99	4.76	4.55	4.35	4.17	3.99	3.84	$\triangle_1$h
Log.	0.815 58	0.790 29	0.765 67	0.741 94	0.720 16	0.698 10	0.677 61	0.658 01	0.638 49	0.620 14	0.600 97	0.584 33	Log.
Limit	20	21	22	23	24	25	26	27	28	29	30	31	Minutes
Meridian	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	Altitudes

Latitude 5° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 59	0 57	0 54	0 52	0 51	0 49	0 47	0 46	0 44	0 43	0 41	0 39	4
8	3 56	3 47	3 39	3 31	3 23	3 16	3 09	3 02	2 57	2 50	2 45	2 40	8
12	8 51	8 31	8 11	7 54	7 36	7 21	7 05	6 50	6 38	6 23	6 12	5 59	12
16	15 45	15 09	14 33	14 02	13 32	13 03	12 35	12 10	11 46	11 21	11 00	10 37	16
20	24 36	23 40	22 44	21 56	21 08	20 24	19 40	19 00	18 24	17 44	17 12	16 36	20
24	35 26	34 05	32 44	31 35	30 26	29 23	28 19	27 22	26 30	25 33	24 46	23 54	24
28	48 13	46 23	44 34	43 00	41 25	39 59	38 33	37 14	36 04	34 45	33 43	32 33	28
32	62 58	60 35	58 12	56 09	54 06	52 13	50 21	48 38	47 06	45 23	44 02	42 30	32
36	79 43	76 41	73 39	71 04	68 29	66 06	63 43	61 34	59 37	57 28	55 44	53 47	36
40	...	...	90 56	87 44	84 32	81 36	78 40	76 00	73 36	70 56	68 48	66 24	40
44	...	...	...	...	...	...	...	...	...	85 50	83 15	80 20	44
48	...	...	...	...	...	...	...	...	...	...	...	95 37	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	3.69	3.55	3.41	3.29	3.17	3.06	2.95	2.85	2.76	2.66	2.58	2.49	Δ_1h
Log.	0.567 03	0.550 23	0.532 75	0.517 20	0.501 06	0.485 72	0.469 82	0.454 84	0.440 91	0.424 88	0.411 62	0.396 20	Log.
Limit	32	32	33	34	35	36	37	38	39	40	41	41	Minutes
Meridian	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 37	0 36	0 35	0 34	0 33	0 31	0 30	0 30	0 29	0 28	0 27	4
8	2 35	2 29	2 25	2 20	2 15	2 11	2 07	2 02	1 59	1 56	1 52	1 48	8
12	5 47	5 35	5 26	5 15	5 05	4 55	4 47	4 37	4 28	4 20	4 12	4 03	12
16	10 17	9 57	9 38	9 21	9 03	8 45	8 29	8 11	7 56	7 44	7 28	7 13	16
20	16 04	15 32	15 04	14 36	14 08	13 40	13 16	12 48	12 24	12 04	11 40	11 16	20
24	23 08	22 22	21 42	21 02	20 22	19 41	19 06	18 26	17 52	17 23	16 48	16 14	24
28	31 30	30 27	29 32	28 37	27 42	26 47	26 01	25 06	24 18	23 39	22 52	22 05	28
32	41 08	39 46	38 34	37 22	36 10	34 59	33 58	32 46	31 44	30 53	29 52	28 50	32
36	52 03	50 20	48 49	47 19	45 48	44 17	42 59	41 28	40 11	39 06	37 48	36 31	36
40	64 16	62 08	60 16	58 24	56 32	54 40	53 04	51 12	49 36	48 16	46 40	45 04	40
44	77 45	75 11	72 55	70 40	68 25	66 09	64 12	61 57	60 01	58 24	56 28	54 32	44
48	92 33	89 28	86 47	84 05	81 24	78 43	76 25	73 44	71 25	69 30	67 10	64 53	48
52	...	105 00	101 51	98 41	95 32	92 23	89 41	86 32	83 49	81 34	78 52	76 09	52
56	...	...	...	...	...	...	104 01	100 21	97 13	94 36	91 28	88 20	56
60	...	...	...	...	...	...	...	...	111 36	108 36	105 00	101 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	2.41	2.33	2.26	2.19	2.12	2.05	1.99	1.92	1.86	1.81	1.75	1.69	Δ_1h
Log.	0.382 02	0.367 36	0.354 11	0.340 44	0.326 34	0.311 75	0.298 85	0.283 30	0.269 51	0.257 68	0.243 04	0.227 89	Log.
Limit	41	42	43	44	44	45	46	47	48	49	50	51	Minutes
Meridian	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 25	0 24	0 23	0 22	0 22	0 22	0 20	0 20	0 19	0 19	0 18	4
8	1 45	1 42	1 38	1 35	1 33	1 29	1 26	1 23	1 20	1 17	1 14	1 11	8
12	3 56	3 49	3 40	3 34	3 28	3 20	3 13	3 06	3 00	2 54	2 47	2 41	12
16	7 00	6 47	6 32	6 18	6 08	5 56	5 43	5 30	5 20	5 10	4 57	4 47	16
20	10 56	10 36	10 12	9 52	9 36	9 16	8 56	8 36	8 20	8 04	7 44	7 28	20
24	15 45	15 16	14 41	14 12	13 49	13 21	12 52	12 23	12 00	11 37	11 09	10 46	24
28	21 25	20 47	20 00	19 21	18 49	18 10	17 30	16 52	16 20	15 49	15 09	14 38	28
32	27 59	27 08	26 07	25 16	24 35	23 43	22 52	22 01	21 20	20 39	19 47	19 06	32
36	35 26	34 21	33 03	31 58	31 06	30 02	28 57	27 52	27 00	26 08	25 04	24 12	36
40	43 44	42 24	40 48	39 28	38 24	37 04	35 44	34 24	33 20	32 16	30 56	29 52	40
44	52 55	51 18	49 22	47 25	46 27	44 51	43 14	41 37	40 20	39 02	37 26	36 09	44
48	62 58	61 03	58 45	56 50	55 18	53 22	51 27	49 32	48 00	46 28	44 32	43 00	48
52	73 54	71 39	68 57	66 42	64 54	62 38	60 23	58 08	56 20	54 32	52 16	50 28	52
56	85 43	83 06	79 58	77 21	75 15	72 39	70 02	67 25	65 20	63 14	60 38	58 33	56
60	98 24	95 24	91 48	88 48	86 24	83 24	80 24	77 24	75 00	72 36	69 36	67 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.64	1.59	1.53	1.48	1.44	1.39	1.34	1.29	1.25	1.21	1.16	1.12	Δ_1h
Log.	0.214 84	0.201 40	0.184 69	0.170 26	0.158 36	0.143 01	0.127 10	0.110 59	0.096 91	0.082 79	0.064 46	0.049 22	Log.
Limit	52	53	55	57	58	59	61	63	64	66	68	70	Minutes
Meridian	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 16	0 15	0 14	0 14	0 14	0 13	0 12	0 11	0 11	0 11	4
8	1 09	1 07	1 04	1 01	0 58	0 56	0 54	0 51	0 50	0 47	0 44	0 41	8
12	2 36	2 30	2 24	2 19	2 13	2 07	2 01	1 55	1 51	1 45	1 39	1 33	12
16	4 36	4 26	4 16	4 05	3 55	3 45	3 35	3 25	3 17	3 07	2 57	2 47	16
20	7 12	6 56	6 40	6 24	6 08	5 52	5 36	5 20	5 08	4 52	4 36	4 20	20
24	10 22	9 59	9 36	9 13	8 50	8 27	8 04	7 41	7 23	7 00	6 38	6 15	24
28	14 07	13 35	13 04	12 33	12 02	11 30	10 58	10 27	10 04	9 33	9 01	8 29	28
32	18 26	17 45	17 04	16 23	15 42	15 01	14 20	13 39	13 09	12 28	11 46	11 05	32
36	23 20	22 28	21 36	20 44	19 52	19 01	18 09	17 17	16 38	15 46	14 55	14 03	36
40	28 48	27 44	26 40	25 36	24 32	23 28	22 24	21 20	20 32	19 28	18 24	17 20	40
44	34 51	33 33	32 16	30 58	29 41	28 24	27 06	25 49	24 51	23 33	22 16	20 59	44
48	41 28	39 56	38 24	36 52	35 20	33 47	32 15	30 43	29 32	28 00	26 29	24 57	48
52	48 40	46 52	45 04	43 16	41 28	39 39	37 51	36 03	34 42	32 54	31 05	29 17	52
56	56 27	54 21	52 16	50 10	48 05	46 00	43 54	41 49	40 15	38 09	36 04	33 59	56
60	64 48	62 24	60 00	57 36	55 12	52 48	50 24	48 00	46 12	43 48	41 24	39 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.08	1.04	1.00	0.96	0.92	0.88	0.84	0.80	0.77	0.73	0.69	0.65	Δ_1h
Log.	0.033 42	0.017 03	0.00 ...	9.982 27	9.963 79	9.944 48	9.924 28	9.903 09	9.886 49	9.863 32	9.838 85	9.812 91	Log.
Limit	71	73	74	75	77	79	81	83	85	87	89	91	Minutes
Meridian	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	Altitudes

Latitude 6° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	4 59	5 58	...	...	...	...	...	...	...	...	...	5 51	4
8	19 55	23 54	...	...	...	...	...	...	...	...	...	23 27	8
12	...	...	...	...	...	...	...	...	...	...	...	...	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	18.68	22.40	...	...	...	...	...	...	...	...	...	21.99	$\triangle_1$h
Log.	1.271 38	1.350 25	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.342 23	Log.
Limit	8	7	6	5	3	2	0	1	3	5	7	8	Minutes
Meridian	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	4 52	4 10	3 38	3 13	2 53	2 36	2 22	2 11	2 01	1 53	1 45	1 39	4
8	19 30	16 39	14 31	12 52	11 32	10 27	9 31	8 46	8 05	7 31	7 01	6 33	8
12	...	37 27	32 39	28 57	25 56	23 30	21 26	19 42	18 12	16 54	15 46	14 45	12
16	...	...	...	51 27	46 08	41 46	38 06	35 02	32 20	30 02	28 02	26 15	16
20	...	...	...	...	...	...	...	54 44	50 32	46 56	43 48	41 00	20
24	...	...	...	...	...	...	...	...	...	...	63 04	59 03	24
28	...	...	...	...	...	...	...	...	...	...	...	80 21	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	18.27	15.61	13.61	12.06	10.81	9.79	8.93	8.21	7.58	7.04	6.57	6.15	$\triangle_1$h
Log.	1.261 74	1.193 40	1.133 86	1.081 35	1.033 83	0.990 78	0.950 85	0.914 34	0.879 67	0.847 57	0.817 57	0.788 88	Log.
Limit	9	10	11	13	14	15	16	17	18	19	20	21	Minutes
Meridian	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 32	1 27	1 22	1 18	1 14	1 10	1 07	1 03	1 00	0 58	0 55	0 53	4
8	6 10	5 49	5 28	5 11	4 54	4 40	4 26	4 13	4 02	3 51	3 41	3 31	8
12	13 51	13 04	12 18	11 40	11 02	10 29	9 59	9 31	9 05	8 39	8 17	7 55	12
16	24 37	23 12	21 54	20 44	19 38	18 39	17 45	16 53	16 07	15 25	14 43	14 05	16
20	38 28	36 16	34 12	32 24	30 40	29 08	27 44	26 24	25 12	24 04	23 00	22 00	20
24	55 23	52 13	49 15	46 40	44 10	41 57	39 57	38 01	36 17	34 40	33 07	31 41	24
28	75 24	71 05	67 02	63 30	60 06	57 06	54 21	51 45	49 24	47 10	45 05	43 07	28
32	...	...	...	82 56	78 30	74 34	70 59	67 35	64 31	61 36	58 53	56 19	32
36	...	...	...	...	...	...	...	...	...	77 59	74 31	71 17	36
40	...	...	...	...	...	...	...	...	...	...	92 00	88 00	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	5.77	5.44	5.13	4.86	4.60	4.37	4.16	3.96	3.78	3.61	3.45	3.30	$\Delta_1 h$
Log.	0.761 18	0.735 60	0.710 12	0.686 64	0.662 76	0.640 48	0.619 09	0.597 70	0.577 49	0.557 51	0.537 82	0.518 51	Log.
Limit	22	23	24	25	26	27	28	29	30	31	32	34	Minutes
Meridian	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 51	0 48	0 46	0 44	0 43	0 41	0 39	0 38	0 36	0 35	0 34	0 32	4
8	3 22	3 14	3 05	2 59	2 51	2 45	2 39	2 32	2 26	2 20	2 15	2 10	8
12	7 35	7 16	6 58	6 42	6 26	6 10	5 56	5 41	5 29	5 15	5 03	4 52	12
16	13 29	12 56	12 22	11 54	11 26	10 58	10 32	10 07	9 43	9 21	9 01	8 40	16
20	21 04	20 12	19 20	18 36	17 52	17 08	16 28	15 48	15 12	14 36	14 04	13 32	20
24	30 21	29 05	27 50	26 47	25 44	24 40	23 42	22 45	21 53	21 02	20 16	19 29	24
28	41 17	39 36	37 54	36 28	35 01	33 35	32 17	30 58	29 48	28 37	27 34	26 32	28
32	53 55	51 43	49 30	47 37	45 44	43 52	42 10	40 27	38 55	37 22	36 00	34 39	32
36	68 16	65 27	62 38	60 16	57 54	55 31	53 21	51 12	49 15	47 19	45 35	43 51	36
40	84 16	80 48	77 20	74 24	71 28	68 32	65 52	63 12	60 48	58 24	56 16	54 08	40
44	...	...	...	...	86 29	82 56	79 42	76 39	73 34	70 40	68 05	65 30	44
48	...	...	...	...	...	...	94 51	91 00	87 33	84 05	81 01	77 57	48
52	...	...	...	...	...	...	...	106 48	102 45	98 41	95 05	91 29	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	3.16	3.03	2.90	2.79	2.68	2.57	2.47	2.37	2.28	2.19	2.11	2.03	$\Delta_1 h$
Log.	0.499 69	0.481 44	0.462 40	0.445 60	0.428 13	0.409 93	0.392 70	0.374 75	0.357 93	0.340 44	0.324 28	0.307 50	Log.
Limit	35	36	37	38	39	40	41	42	43	43	44	45	Minutes
Meridian	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	Altitudes

Latitude 6° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 30	0 29	0 28	0 27	0 26	0 25	0 23	0 22	0 22	0 21	0 20	4
8	2 04	2 00	1 56	1 52	1 47	1 42	1 39	1 35	1 32	1 28	1 23	1 21	8
12	4 41	4 31	4 20	4 11	4 00	3 51	3 42	3 34	3 24	3 17	3 08	3 02	12
16	8 19	8 01	7 44	7 25	7 08	6 53	6 34	6 18	6 06	5 51	5 36	5 22	16
20	13 00	12 32	12 04	11 36	11 08	10 44	10 16	9 52	9 32	9 08	8 44	8 24	20
24	18 43	18 03	17 23	16 42	16 02	15 28	14 47	14 12	13 43	13 09	12 35	12 06	24
28	25 29	24 34	23 39	22 44	21 49	21 02	20 07	19 21	18 42	17 54	17 07	16 28	28
32	33 17	32 05	30 53	29 42	28 30	27 28	26 17	25 16	24 25	23 23	22 21	21 30	32
36	42 07	40 37	39 06	37 35	36 05	34 47	33 16	31 58	30 53	29 36	28 18	27 13	36
40	52 00	50 08	48 16	46 24	44 32	42 56	41 04	39 28	38 08	36 32	34 56	33 36	40
44	62 55	60 40	58 24	56 08	53 54	51 57	49 41	47 45	46 08	44 13	42 16	40 39	44
48	74 53	72 11	69 30	66 47	64 07	61 49	59 08	56 50	54 55	52 36	50 18	48 23	48
52	87 53	84 43	81 34	78 25	75 15	72 33	69 24	66 42	64 27	61 44	59 02	56 47	52
56	101 51	98 15	94 36	90 56	87 18	84 09	80 29	77 21	74 44	71 37	68 28	65 51	56
60	. . .	112 48	108 36	104 24	100 12	96 36	92 24	88 48	85 48	82 12	78 36	75 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.95	1.88	1.81	1.74	1.67	1.61	1.54	1.48	1.43	1.37	1.31	1.26	$\Delta_1 h$
Log.	0.290 03	0.274 16	0.257 68	0.240 55	0.222 72	0.206 83	0.187 52	0.170 26	0.155 34	0.136 72	0.117 27	0.100 37	Log.
Limit	46	47	48	49	51	53	54	55	56	57	59	61	Minutes
Meridian	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 13	0 12	0 12	0 11	4
8	1 17	1 14	1 11	1 08	1 04	1 01	0 58	0 55	0 53	0 51	0 47	0 44	8
12	2 54	2 47	2 39	2 33	2 25	2 19	2 13	2 05	1 59	1 54	1 47	1 39	12
16	5 10	4 57	4 45	4 31	4 19	4 05	3 55	3 43	3 33	3 22	3 09	2 57	16
20	8 04	7 44	7 24	7 04	6 44	6 24	6 08	5 48	5 32	5 16	4 56	4 36	20
24	11 37	11 09	10 40	10 11	9 42	9 13	8 50	8 21	7 58	7 35	7 06	6 38	24
28	15 49	15 09	14 30	13 51	13 12	12 33	12 02	11 22	10 51	10 20	9 40	9 01	28
32	20 39	19 47	18 56	18 05	17 14	16 23	15 42	14 51	14 10	13 29	12 38	11 46	32
36	26 08	25 04	23 59	22 54	21 49	20 44	19 52	18 48	17 56	17 04	15 59	14 55	36
40	32 16	30 56	29 36	28 16	26 56	25 36	24 32	23 12	22 08	21 04	19 44	18 24	40
44	39 02	37 26	35 49	34 12	32 35	30 58	29 41	28 05	26 47	25 29	23 52	22 16	44
48	46 28	44 32	42 37	40 42	38 47	36 52	35 20	33 24	31 52	30 18	28 23	26 29	48
52	54 32	52 16	50 01	47 46	45 31	43 16	41 28	39 12	37 24	35 36	33 21	31 05	52
56	63 14	60 38	58 01	55 24	52 47	50 10	48 05	45 29	43 23	41 17	38 40	36 04	56
60	72 36	69 36	66 36	63 36	60 36	57 36	55 12	52 12	49 48	47 24	44 24	41 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.21	1.16	1.11	1.06	1.01	0.96	0.92	0.87	0.83	0.79	0.74	0.69	$\Delta_1 h$
Log.	0.082 79	0.064 46	0.045 32	0.025 31	0.004 32	9.982 27	9.963 79	9.939 52	9.919 08	9.897 63	9.869 23	9.838 85	Log.
Limit	63	65	67	69	71	73	75	77	79	81	83	85	Minutes
Meridian	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	Altitudes

Latitude 6° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	4 59	4 16	3 44	3 19	2 59	2 43	2 30	2 18	2 07	1 59	1 51	1 45	4
8	19 55	17 04	14 57	13 19	11 57	10 53	10 01	9 11	8 31	7 57	7 26	7 00	8
12	...	38 27	33 39	29 56	26 56	24 29	22 32	20 41	19 11	17 53	16 46	15 45	12
16	...	...	...	53 12	47 52	43 31	40 04	36 47	34 05	31 47	29 46	27 59	16
20	...	...	...	...	...	...	...	57 28	53 16	49 40	46 32	43 44	20
24	...	...	...	...	...	...	...	...	...	...	...	62 59	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	18.68	16.02	14.02	12.47	11.22	10.20	9.39	8.62	7.99	7.45	6.98	6.56	$\triangle_1 h$
Log.	1.271 38	1.204 66	1.146 75	1.095 87	1.049 99	1.008 60	0.972 67	0.935 51	0.902 55	0.872 16	0.843 86	0.816 90	Log.
Limit	8	9	10	11	12	14	15	16	17	18	19	20	Minutes
Meridian	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 39	1 34	1 29	1 24	1 20	1 16	1 13	1 10	1 07	1 04	1 02	0 59	4
8	6 35	6 14	5 55	5 37	5 21	5 06	4 53	4 40	4 28	4 17	4 07	3 58	8
12	14 50	14 01	13 18	12 38	12 01	11 29	10 58	10 29	10 03	9 39	9 16	8 54	12
16	26 22	24 55	23 38	22 26	21 23	20 23	19 30	18 39	17 53	17 09	16 28	15 50	16
20	41 12	38 56	36 56	35 04	33 24	31 52	30 28	29 08	27 56	26 48	25 44	24 44	20
24	59 20	56 04	53 11	50 30	48 06	45 53	43 52	41 57	40 14	38 36	37 04	35 37	24
28	80 45	76 18	72 23	68 44	65 28	62 26	59 43	57 06	54 45	52 32	50 26	48 29	28
32	...	...	...	...	...	81 35	78 00	74 34	71 30	68 36	65 52	63 19	32
36	...	...	...	...	...	...	...	...	...	...	...	80 08	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.18	5.84	5.54	5.26	5.01	4.78	4.57	4.37	4.19	4.02	3.86	3.71	$\triangle_1 h$
Log.	0.790 99	0.766 41	0.743 51	0.720 99	0.699 84	0.679 43	0.659 92	0.640 48	0.622 21	0.604 23	0.586 59	0.569 37	Log.
Limit	21	22	23	24	24	25	26	27	28	29	30	31	Minutes
Meridian	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	Altitudes

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Latitude 6° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 57	0 55	0 53	0 51	0 49	0 47	0 46	0 44	0 43	0 42	0 40	0 39	4
8	3 49	3 41	3 32	3 24	3 17	3 10	3 04	2 58	2 52	2 46	2 41	2 37	8
12	8 34	8 16	7 56	7 39	7 24	7 10	6 55	6 41	6 27	6 14	6 03	5 52	12
16	15 14	14 40	14 08	13 37	13 08	12 42	12 17	11 51	11 29	11 06	10 45	10 24	16
20	23 48	22 56	22 04	21 16	20 32	19 52	19 12	18 32	17 56	17 20	16 48	16 16	20
24	34 16	33 01	31 47	30 38	29 34	28 36	27 39	26 41	25 50	24 58	24 12	23 25	24
28	46 39	44 57	43 15	41 41	40 15	38 57	37 38	36 20	35 09	33 58	32 56	31 53	28
32	60 56	58 43	56 29	54 26	52 34	50 52	49 09	47 27	45 54	44 22	43 00	41 39	32
36	77 07	74 18	71 30	68 55	66 32	64 22	62 13	60 03	58 07	56 10	54 26	52 42	36
40	...	91 44	88 16	85 04	82 08	79 28	76 48	74 08	71 44	69 20	67 12	65 04	40
44	...	...	...	...	...	...	...	...	86 48	83 54	81 19	78 43	44
48	...	...	...	...	...	...	...	...	...	...	...	93 42	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	3.57	3.44	3.31	3.19	3.08	2.98	2.88	2.78	2.69	2.60	2.52	2.44	△₁h
Log.	0.552 67	0.536 56	0.519 83	0.503 79	0.488 55	0.474 22	0.459 39	0.444 04	0.429 75	0.414 97	0.401 40	0.387 39	Log.
Limit	32	33	34	35	36	37	38	38	39	40	41	42	Minutes
Meridian	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 36	0 35	0 35	0 33	0 32	0 31	0 30	0 29	0 28	0 27	0 27	4
8	2 31	2 27	2 22	2 17	2 13	2 09	2 04	2 01	1 57	1 54	1 50	1 47	8
12	5 40	5 30	5 20	5 09	5 00	4 49	4 41	4 32	4 23	4 17	4 08	4 00	12
16	10 04	9 46	9 28	9 11	8 52	8 35	8 19	8 04	7 49	7 35	7 20	7 08	16
20	15 44	15 16	14 48	14 20	13 52	13 24	13 00	12 36	12 12	11 52	11 28	11 08	20
24	22 40	21 59	21 19	20 39	19 58	19 18	18 43	18 09	17 34	17 05	16 31	16 02	24
28	30 50	29 56	29 01	28 05	27 11	26 16	25 29	24 42	23 55	23 16	22 29	21 49	28
32	40 16	39 05	37 53	36 41	35 30	34 18	33 17	32 15	31 13	30 23	29 21	28 30	32
36	50 59	49 28	47 57	46 27	44 56	43 25	42 07	40 50	39 32	38 27	37 09	36 05	36
40	62 56	61 04	59 12	57 20	55 28	53 36	52 00	50 24	48 48	47 28	45 52	44 32	40
44	76 09	73 53	71 38	69 23	67 07	64 51	62 55	60 59	59 03	57 26	55 30	53 54	44
48	90 37	87 56	85 15	82 33	79 52	77 11	74 53	72 34	70 16	68 19	66 01	64 07	48
52	106 21	103 12	100 03	96 53	93 44	90 35	87 53	85 10	82 28	80 13	77 31	75 15	52
56	...	...	...	...	...	105 03	101 55	98 47	95 39	93 02	89 54	87 18	56
60	...	...	...	...	...	...	...	113 24	109 48	106 48	103 12	100 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.36	2.29	2.22	2.15	2.08	2.01	1.95	1.89	1.83	1.78	1.72	1.67	△₁h
Log.	0.372 91	0.359 84	0.346 35	0.332 44	0.318 06	0.303 20	0.290 03	0.276 46	0.262 45	0.250 42	0.235 53	0.222 72	Log.
Limit	42	43	43	44	45	46	47	48	49	50	51	52	Minutes
Meridian	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	Altitudes

Latitude 6° Declination Contrary Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 26	0 25	0 24	0 23	0 22	0 22	0 21	0 20	0 20	0 19	0 19	0 18	4
8	1 43	1 40	1 36	1 34	1 31	1 28	1 24	1 22	1 20	1 16	1 13	1 11	8
12	3 53	3 45	3 37	3 31	3 25	3 17	3 10	3 05	2 59	2 51	2 45	2 39	12
16	6 55	6 39	6 27	6 13	6 03	5 51	5 38	5 27	5 17	5 05	4 55	4 45	16
20	10 48	10 24	10 04	9 44	9 28	9 08	8 48	8 32	8 16	7 56	7 40	7 24	20
24	15 34	14 59	14 30	14 01	13 38	13 09	12 41	12 17	11 54	11 26	11 03	10 40	24
28	21 10	20 23	19 44	19 05	18 34	17 54	17 15	16 44	16 12	15 33	15 01	14 30	28
32	27 38	26 37	25 46	24 55	24 14	23 23	22 31	21 51	21 10	20 18	19 37	18 56	32
36	35 00	33 42	32 37	31 32	30 40	29 36	28 31	27 39	26 47	25 43	24 51	23 59	36
40	43 12	41 36	40 16	38 56	37 52	36 32	35 12	34 08	33 04	31 44	30 40	29 36	40
44	52 17	50 20	48 43	47 06	45 49	44 13	42 36	41 18	40 00	38 24	37 07	35 49	44
48	62 12	59 54	57 59	56 04	54 32	52 36	50 41	49 09	47 37	45 41	44 09	42 37	48
52	73 00	70 18	68 03	65 48	64 00	61 44	59 29	57 41	55 53	53 37	51 49	50 01	52
56	84 41	81 32	78 55	76 18	74 13	71 37	69 00	66 54	64 48	62 12	60 07	58 01	56
60	97 12	93 36	90 36	87 36	85 12	82 12	79 12	76 48	74 24	71 24	69 00	66 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.62	1.56	1.51	1.46	1.42	1.37	1.32	1.28	1.24	1.19	1.15	1.11	$\triangle_1$h
Log.	0.209 52	0.193 12	0.178 98	0.164 35	0.152 29	0.136 72	0.120 57	0.107 21	0.093 42	0.075 55	0.060 70	0.045 32	Log.
Limit	53	55	56	57	58	60	62	64	65	67	69	71	Minutes
Meridian	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 16	0 15	0 15	0 14	0 14	0 13	0 13	0 12	0 11	0 11	0 11	4
8	1 08	1 06	1 03	1 01	0 58	0 55	0 53	0 51	0 49	0 46	0 44	0 42	8
12	2 34	2 28	2 23	2 17	2 11	2 05	1 59	1 55	1 50	1 44	1 39	1 35	12
16	4 34	4 24	4 13	4 03	3 53	3 43	3 33	3 25	3 14	3 04	2 57	2 49	16
20	7 08	6 52	6 36	6 20	6 04	5 48	5 32	5 20	5 04	4 48	4 36	4 24	20
24	10 16	9 53	9 30	9 07	8 44	8 21	7 58	7 41	7 18	6 55	6 38	6 21	24
28	13 59	13 28	12 57	12 25	11 54	11 22	10 51	10 27	9 56	9 25	9 01	8 37	28
32	18 16	17 35	16 54	16 13	15 32	14 51	14 10	13 39	12 58	12 17	11 46	11 15	32
36	23 07	22 15	21 23	20 31	19 39	18 48	17 56	17 17	16 25	15 33	14 55	14 16	36
40	28 32	27 28	26 24	25 20	24 16	23 12	22 08	21 20	20 16	19 12	18 24	17 36	40
44	34 32	33 14	31 56	30 39	29 21	28 05	26 47	25 49	24 31	23 14	22 16	21 18	44
48	41 05	39 33	38 01	36 29	34 57	33 24	31 52	30 43	29 09	27 37	26 29	25 20	48
52	48 13	46 25	44 37	42 49	41 01	39 12	37 24	36 03	34 15	32 27	31 05	29 44	52
56	55 56	53 50	51 44	49 39	47 33	45 29	43 23	41 49	39 43	37 38	36 04	34 30	56
60	64 12	61 48	59 24	57 00	54 36	52 12	49 48	48 00	45 36	43 12	41 24	39 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.07	1.03	0.99	0.95	0.91	0.87	0.83	0.80	0.76	0.72	0.69	0.66	$\triangle_1$h
Log.	0.029 38	0.012 84	9.995 64	9.977 72	9.959 04	9.939 52	9.919 08	9.903 09	9.880 81	9.857 33	9.838 85	9.819 54	Log.
Limit	72	74	75	76	77	79	81	83	85	87	90	93	Minutes
Meridian	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	Altitudes

Latitude 7° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	4 16	4 59	5 58	...	...	...	...	...	...	...	...	...	4
8	17 03	19 53	23 50	...	...	...	...	...	...	...	...	...	8
12	38 23	...	...	...	...	...	...	...	...	...	...	...	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	15.99	18.64	22.35	...	...	...	...	...	...	...	...	...	Δ_1h
Log.	1.203 85	1.270 45	1.349 28	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	9	8	7	5	4	3	1	0	1	3	5	7	Minutes
Meridian	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	5 50	4 51	4 08	3 37	3 12	2 51	2 35	2 22	2 10	2 00	1 51	1 44	4
8	23 20	19 23	16 33	14 26	12 47	11 27	10 22	9 27	8 41	8 01	7 26	6 57	8
12	...	...	37 15	32 28	28 45	25 45	23 18	21 16	19 32	18 03	16 46	15 37	12
16	...	...	...	...	...	45 47	41 26	37 48	34 44	32 05	29 46	27 47	16
20	...	...	...	...	...	...	...	...	54 16	50 08	46 32	43 24	20
24	...	...	...	...	...	...	...	...	...	...	...	62 30	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	21.87	18.17	15.52	13.53	11.98	10.73	9.71	8.86	8.14	7.52	6.98	6.51	Δ_1h
Log.	1.339 85	1.259 35	1.190 89	1.131 30	1.078 46	1.030 60	0.987 22	0.947 43	0.910 62	0.876 22	0.843 86	0.813 58	Log.
Limit	9	10	11	12	13	14	15	16	18	19	20	21	Minutes
Meridian	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	Altitudes

Latitude 7° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 37	1 31	1 26	1 21	1 17	1 13	1 09	1 06	1 02	0 59	0 57	0 54	4
8	6 30	6 06	5 44	5 25	5 07	4 51	4 36	4 23	4 10	4 00	3 48	3 38	8
12	14 37	13 44	12 55	12 12	11 31	10 55	10 22	9 51	9 23	8 57	8 33	8 10	12
16	25 59	24 24	22 57	21 40	20 39	19 25	18 26	17 33	16 41	15 55	15 11	14 30	16
20	40 36	38 08	35 52	33 52	32 00	30 20	28 48	27 24	26 04	24 52	23 44	22 40	20
24	58 28	54 55	51 39	48 46	46 05	43 41	41 29	39 28	37 32	35 48	34 11	32 38	24
28	79 35	74 45	70 18	66 23	62 43	59 27	56 27	53 42	51 06	48 45	46 31	44 26	28
32	...	...	...	...	81 55	77 39	73 43	70 08	66 44	63 40	60 45	58 02	32
36	...	...	...	...	...	...	...	...	...	...	76 54	73 26	36
40	...	...	...	...	...	...	...	...	...	...	...	90 40	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	6.09	5.72	5.38	5.08	4.80	4.55	4.32	4.11	3.91	3.73	3.56	3.40	$\triangle_1$h
Log.	0.784 62	0.757 40	0.730 78	0.705 86	0.681 24	0.658 01	0.635 48	0.613 84	0.592 18	0.571 71	0.551 45	0.531 48	Log.
Limit	22	22	23	24	25	26	28	29	30	31	32	33	Minutes
Meridian	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 52	0 50	0 47	0 46	0 44	0 42	0 40	0 38	0 37	0 36	0 35	0 33	4
8	3 28	3 19	3 10	3 03	2 56	2 48	2 42	2 35	2 29	2 24	2 17	2 13	8
12	7 48	7 27	7 10	6 52	6 35	6 18	6 04	5 49	5 35	5 23	5 09	4 58	12
16	13 52	13 17	12 42	12 12	11 41	11 14	10 48	10 19	9 57	9 33	9 11	8 50	16
20	21 40	20 44	19 52	19 04	18 16	17 32	16 52	16 08	15 32	14 56	14 20	13 48	20
24	31 12	29 52	28 36	27 28	26 18	25 15	24 17	23 14	22 22	21 30	20 39	19 52	24
28	42 28	40 38	38 57	37 22	35 48	34 22	33 04	31 38	30 27	29 16	28 05	27 03	28
32	55 28	53 04	50 52	48 48	46 46	44 53	43 11	41 18	39 46	38 14	36 41	35 20	32
36	70 12	67 11	64 22	61 47	59 11	56 49	54 39	52 16	50 20	48 23	46 27	44 43	36
40	86 40	82 56	79 28	76 16	73 04	70 08	67 28	64 32	62 08	59 44	57 20	55 12	40
44	...	...	...	...	88 24	84 52	81 38	78 05	75 11	72 16	69 23	66 48	44
48	...	...	...	...	...	...	...	92 56	89 28	86 01	82 33	79 29	48
52	...	...	...	...	...	...	...	...	105 00	100 57	96 53	93 17	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.25	3.11	2.98	2.86	2.74	2.63	2.53	2.42	2.33	2.24	2.15	2.07	$\triangle_1$h
Log.	0.511 88	0.492 76	0.474 22	0.456 37	0.437 75	0.419 96	0.403 12	0.383 82	0.367 36	0.350 25	0.332 44	0.315 97	Log.
Limit	34	35	36	37	38	39	40	41	42	42	43	44	Minutes
Meridian	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	Altitudes

Latitude 7° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 30	0 30	0 28	0 27	0 26	0 25	0 24	0 22	0 22	0 21	0 20	4
8	2 07	2 02	1 58	1 54	1 49	1 44	1 41	1 36	1 33	1 29	1 25	1 21	8
12	4 47	4 35	4 25	4 16	4 05	3 54	3 46	3 36	3 28	3 20	3 11	3 03	12
16	8 29	8 09	7 51	7 33	7 15	6 58	6 42	6 24	6 08	5 56	5 41	5 25	16
20	13 16	12 44	12 16	11 48	11 20	10 52	10 28	10 00	9 36	9 16	8 52	8 28	20
24	19 06	18 20	17 40	16 59	16 19	15 39	15 04	14 24	13 49	13 21	12 46	12 11	24
28	26 01	24 58	24 02	23 08	22 13	21 18	20 31	19 36	18 49	18 10	17 23	16 36	28
32	33 58	32 36	31 24	30 13	29 01	27 49	26 48	25 36	24 35	23 43	22 42	21 41	32
36	42 59	41 15	39 45	38 14	36 43	35 13	33 55	32 24	31 06	30 02	28 44	27 26	36
40	53 04	50 56	49 04	47 12	45 20	43 28	41 52	40 00	38 24	37 04	35 28	33 52	40
44	64 12	61 37	59 22	57 07	54 51	52 36	50 40	48 24	46 27	44 51	42 55	40 59	44
48	76 25	73 21	70 39	67 56	65 15	62 35	60 17	57 36	55 18	53 22	51 04	48 46	48
52	89 41	86 05	82 55	79 46	76 37	73 27	70 45	67 36	64 54	62 38	59 56	57 14	52
56	104 01	99 49	96 10	92 31	88 51	85 12	82 04	78 24	75 15	72 39	69 31	66 23	56
60	119 24	114 36	110 24	106 12	102 00	97 48	94 12	90 00	86 24	83 24	79 48	76 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.99	1.91	1.84	1.77	1.70	1.63	1.57	1.50	1.44	1.39	1.33	1.27	$\triangle_1 h$
Log.	0.298 85	0.281 03	0.264 82	0.247 97	0.230 45	0.212 19	0.195 90	0.176 09	0.158 36	0.143 01	0.123 85	0.103 80	Log.
Limit	45	46	47	48	50	52	53	54	55	56	58	60	Minutes
Meridian	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 13	0 12	0 12	0 11	4
8	1 18	1 15	1 11	1 08	1 05	1 02	0 58	0 55	0 53	0 51	0 48	0 45	8
12	2 56	2 48	2 41	2 34	2 27	2 20	2 13	2 05	1 59	1 54	1 48	1 42	12
16	5 12	5 00	4 47	4 34	4 21	4 08	3 55	3 43	3 33	3 22	3 12	3 02	16
20	8 08	7 48	7 28	7 08	6 48	6 28	6 08	5 48	5 32	5 16	5 00	4 44	20
24	11 43	11 14	10 46	10 16	9 48	9 18	8 50	8 21	7 58	7 35	7 12	6 49	24
28	15 57	15 17	14 38	13 59	13 20	12 41	12 02	11 22	10 51	10 20	9 48	9 17	28
32	20 49	19 58	19 06	18 16	17 24	16 34	15 42	14 51	14 10	13 29	12 48	12 07	32
36	26 21	25 17	24 12	23 07	22 02	20 57	19 52	18 48	17 56	17 04	16 12	15 20	36
40	32 32	31 12	29 52	28 32	27 12	25 52	24 32	23 12	22 08	21 04	20 00	18 56	40
44	39 22	37 46	36 09	34 32	32 55	31 18	29 41	28 05	26 47	25 29	24 12	22 54	44
48	46 51	44 55	43 00	41 05	39 10	37 15	35 20	33 24	31 52	30 18	28 46	27 14	48
52	54 59	52 43	50 28	48 13	45 58	43 43	41 28	39 12	37 24	35 36	33 48	32 00	52
56	63 46	61 10	58 33	55 56	53 19	50 42	48 05	45 29	43 23	41 17	39 12	37 06	56
60	73 12	70 12	67 12	64 12	61 12	58 12	55 12	52 12	49 48	47 24	45 00	42 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.22	1.17	1.12	1.07	1.02	0.97	0.92	0.87	0.83	0.79	0.75	0.71	$\triangle_1 h$
Log.	0.086 36	0.068 19	0.049 22	0.029 38	0.008 60	9.986 77	9.963 79	9.939 52	9.919 08	9.897 63	9.875 06	9.851 26	Log.
Limit	62	64	66	68	70	72	74	76	78	80	82	84	Minutes
Meridian	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	Altitudes

Latitude 7° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	4 16	3 44	3 19	2 59	2 43	2 29	2 18	2 08	1 59	1 51	1 45	1 39	4
8	17 03	14 56	13 17	11 57	10 52	9 58	9 11	8 32	7 58	7 26	7 00	6 36	8
12	38 23	33 36	29 53	26 54	24 27	22 25	20 41	19 12	17 55	16 46	15 45	14 51	12
16	...	...	...	...	43 29	39 51	36 47	34 08	31 49	29 46	27 59	26 25	16
20	...	...	...	...	...	...	57 28	53 20	49 44	46 32	43 44	41 16	20
24	...	...	...	...	...	...	...	...	...	...	62 59	59 26	24
28	...	...	...	...	...	...	...	...	...	...	...	80 53	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	15.99	14.00	12.45	11.21	10.19	9.34	8.62	8.00	7.46	6.98	6.56	6.19	$\triangle_1$h
Log.	1.203 85	1.146 13	1.095 17	1.049 61	1.008 17	0.970 35	0.935 51	0.903 09	0.872 74	0.843 86	0.816 90	0.791 69	Log.
Limit	9	11	12	13	14	15	16	17	18	19	20	21	Minutes
Meridian	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 34	1 29	1 24	1 20	1 16	1 13	1 10	1 07	1 04	1 02	0 59	0 57	4
8	6 15	5 55	5 38	5 22	5 07	4 53	4 41	4 29	4 18	4 08	4 00	3 50	8
12	14 04	13 19	12 41	12 04	11 30	11 00	10 32	10 05	9 40	9 19	8 57	8 37	12
16	25 00	23 41	22 31	21 28	20 26	19 32	18 44	17 55	17 12	16 33	15 55	15 19	16
20	39 04	37 00	35 12	33 32	31 56	30 32	29 16	28 00	26 52	25 52	24 52	23 56	20
24	56 16	53 17	50 41	48 17	45 59	43 58	42 09	40 19	38 41	37 15	35 48	34 28	24
28	76 34	72 31	69 00	65 44	62 34	59 51	57 22	54 53	52 40	50 42	48 45	46 55	28
32	...	...	...	...	81 45	78 10	74 55	71 41	68 47	66 13	63 40	61 16	32
36	...	...	...	...	...	...	...	...	...	...	...	77 33	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	5.86	5.55	5.28	5.03	4.79	4.58	4.39	4.20	4.03	3.88	3.73	3.59	$\triangle_1$h
Log.	0.767 90	0.744 29	0.722 63	0.701 57	0.680 34	0.660 87	0.642 46	0.623 25	0.605 31	0.588 83	0.571 71	0.555 09	Log.
Limit	22	23	24	24	25	26	27	28	29	30	31	32	Minutes
Meridian	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	Altitudes

Latitude 7° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 55	0 53	0 51	0 50	0 48	0 46	0 45	0 43	0 42	0 41	0 39	0 38	4
8	3 42	3 33	3 26	3 19	3 12	3 05	2 59	2 54	2 48	2 43	2 38	2 33	8
12	8 19	7 59	7 44	7 27	7 12	6 58	6 43	6 30	6 18	6 06	5 55	5 44	12
16	14 45	14 13	13 44	13 17	12 48	12 22	11 57	11 34	11 14	10 50	10 29	10 12	16
20	23 04	22 12	21 28	20 44	20 00	19 20	18 40	18 04	17 32	16 56	16 24	15 56	20
24	33 13	31 58	30 55	29 52	28 48	27 50	26 53	26 01	25 15	24 23	23 37	22 57	24
28	45 13	43 31	42 05	40 38	39 12	37 54	36 35	35 25	34 22	33 11	32 09	31 14	28
32	59 03	56 50	54 57	53 04	51 12	49 30	47 47	46 15	44 53	43 21	41 59	40 47	32
36	74 44	71 56	69 33	67 11	64 48	62 38	60 29	58 32	56 49	54 52	53 08	51 38	36
40	92 16	88 48	85 52	82 56	80 00	77 20	74 40	72 16	70 08	67 44	65 36	63 44	40
44	...	...	...	...	...	...	...	87 26	84 52	81 57	79 22	77 07	44
48	...	...	...	...	...	...	...	...	...	...	94 28	91 46	48
52	...	...	...	...	...	...	...	...	...	...	...	107 42	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.46	3.33	3.22	3.11	3.00	2.90	2.80	2.71	2.63	2.54	2.46	2.39	$\triangle_1$h
Log.	0.539 08	0.522 44	0.507 86	0.492 76	0.477 12	0.462 40	0.447 16	0.432 97	0.419 96	0.404 83	0.390 94	0.378 40	Log.
Limit	33	34	35	36	37	38	38	39	40	41	42	42	Minutes
Meridian	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 37	0 36	0 35	0 34	0 33	0 31	0 30	0 30	0 29	0 28	0 27	0 27	4
8	2 28	2 24	2 19	2 15	2 11	2 05	2 02	1 59	1 55	1 52	1 49	1 45	8
12	5 32	5 23	5 12	5 03	4 54	4 44	4 37	4 28	4 19	4 12	4 05	3 56	12
16	9 52	9 33	9 16	9 01	8 42	8 24	8 11	7 56	7 41	7 28	7 15	7 00	16
20	15 24	14 56	14 28	14 04	13 36	13 08	12 48	12 24	12 00	11 40	11 20	10 56	20
24	22 11	21 30	20 50	20 16	19 35	18 54	18 26	17 52	17 17	16 48	16 19	15 45	24
28	30 11	29 16	28 21	27 34	26 39	25 45	25 06	24 18	23 31	22 52	22 13	21 25	28
32	39 25	38 14	37 02	36 00	34 49	33 38	32 46	31 44	30 43	29 52	29 01	27 59	32
36	49 54	48 23	46 53	45 35	44 04	42 33	41 28	40 11	38 53	37 48	36 43	35 26	36
40	61 36	59 44	57 52	56 16	54 24	52 32	51 12	49 36	48 00	46 40	45 20	43 44	40
44	74 32	72 16	70 02	68 05	65 49	63 34	61 57	60 01	58 05	56 28	54 51	52 55	44
48	88 42	86 01	83 19	81 01	78 20	75 39	73 44	71 25	69 07	67 10	65 15	62 58	48
52	104 06	100 57	97 47	95 05	91 56	88 47	86 32	83 49	81 07	78 52	76 37	73 54	52
56	...	...	...	...	...	102 57	100 21	97 13	94 05	91 28	88 51	85 43	56
60	...	...	...	...	...	...	...	111 36	108 00	105 00	102 00	98 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.31	2.24	2.17	2.11	2.04	1.97	1.92	1.86	1.80	1.75	1.70	1.64	$\triangle_1$h
Log.	0.363 61	0.350 25	0.336 46	0.324 28	0.309 63	0.294 47	0.283 30	0.269 51	0.255 27	0.243 04	0.230 45	0.214 84	Log.
Limit	43	44	45	46	46	47	48	49	50	51	52	53	Minutes
Meridian	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	Altitudes

Latitude 7° Declination Contrary Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 25	0 23	0 22	0 22	0 22	0 21	0 20	0 19	0 19	0 19	0 18	4
8	1 42	1 39	1 36	1 33	1 30	1 26	1 23	1 21	1 18	1 15	1 13	1 10	8
12	3 49	3 42	3 35	3 28	3 23	3 14	3 08	3 02	2 56	2 50	2 44	2 38	12
16	6 47	6 34	6 21	6 08	5 58	5 46	5 36	5 22	5 12	5 02	4 52	4 42	16
20	10 36	10 16	9 56	9 36	9 20	9 00	8 44	8 24	8 08	7 52	7 36	7 20	20
24	15 16	14 47	14 18	13 49	13 26	12 58	12 35	12 06	11 43	11 20	10 57	10 34	24
28	20 47	20 07	19 29	18 49	18 18	17 38	17 07	16 28	15 57	15 25	14 53	14 22	28
32	27 08	26 17	25 26	24 35	23 54	23 02	22 21	21 30	20 49	20 08	19 27	18 46	32
36	34 21	33 16	32 11	31 06	30 14	29 10	28 18	27 13	26 21	25 30	24 38	23 46	36
40	42 24	41 04	39 44	38 24	37 20	36 00	34 56	33 36	32 32	31 28	30 24	29 20	40
44	51 18	49 41	48 04	46 27	45 10	43 34	42 16	40 39	39 22	38 05	36 47	35 30	44
48	61 03	59 08	57 13	55 18	53 46	51 50	50 18	48 23	46 51	45 18	43 46	42 14	48
52	71 39	69 24	67 09	64 54	63 06	60 50	59 02	56 47	54 59	53 10	51 22	49 34	52
56	83 06	80 29	77 52	75 15	73 10	70 34	68 28	65 51	63 46	61 41	59 35	57 30	56
60	95 24	92 24	89 24	86 24	84 00	81 00	78 36	75 36	73 12	70 48	68 24	66 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.59	1.54	1.49	1.44	1.40	1.35	1.31	1.26	1.22	1.18	1.14	1.10	$\triangle_1 h$
Log.	0.201 40	0.187 52	0.173 19	0.158 36	0.146 13	0.130 33	0.117 27	0.100 37	0.086 36	0.071 88	0.056 90	0.041 39	Log.
Limit	54	56	57	58	59	61	63	65	66	68	70	72	Minutes
Meridian	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 16	0 15	0 15	0 14	0 14	0 13	0 13	0 12	0 11	0 11	0 11	4
8	1 08	1 05	1 02	1 00	0 57	0 55	0 53	0 51	0 49	0 46	0 44	0 42	8
12	2 33	2 27	2 22	2 16	2 10	2 04	1 59	1 55	1 50	1 44	1 39	1 35	12
16	4 31	4 21	4 10	4 00	3 50	3 40	3 33	3 25	3 14	3 04	2 57	2 49	16
20	7 04	6 48	6 32	6 16	6 00	5 44	5 32	5 20	5 04	4 48	4 36	4 24	20
24	10 11	9 48	9 24	9 01	8 38	8 16	7 58	7 41	7 18	6 55	6 38	6 21	24
28	13 51	13 20	12 49	12 17	11 46	11 14	10 51	10 27	9 56	9 25	9 01	8 37	28
32	18 05	17 24	16 44	16 03	15 22	14 40	14 10	13 39	12 58	12 17	11 46	11 15	32
36	22 54	22 02	21 10	20 18	19 26	18 35	17 56	17 17	16 25	15 33	14 55	14 16	36
40	28 16	27 12	26 08	25 04	24 00	22 56	22 08	21 20	20 16	19 12	18 24	17 36	40
44	34 12	32 55	31 37	30 19	29 02	27 45	26 47	25 49	24 31	23 14	22 16	21 18	44
48	40 42	39 10	37 38	36 06	34 34	33 01	31 52	30 43	29 09	27 37	26 29	25 20	48
52	47 46	45 58	44 10	42 22	40 34	38 45	37 24	36 03	34 15	32 27	31 05	29 44	52
56	55 24	53 19	51 13	49 07	47 02	44 57	43 23	41 49	39 43	37 38	36 04	34 30	56
60	63 36	61 12	58 48	56 24	54 00	51 36	49 48	48 00	45 36	43 12	41 24	39 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.06	1.02	0.98	0.94	0.90	0.86	0.83	0.80	0.76	0.72	0.69	0.66	$\triangle_1 h$
Log.	0.025 31	0.008 60	9.991 23	9.973 13	9.954 24	9.934 50	9.919 08	9.903 09	9.880 81	9.857 33	9.838 85	9.819 54	Log.
Limit	73	75	76	77	78	80	82	83	85	87	90	93	Minutes
Meridian	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	Altitudes

Latitude 8° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 43	4 15	4 57	5 56	...	...	...	...	...	...	...	...	4
8	14 54	17 01	19 50	23 46	...	...	...	...	...	...	...	...	8
12	33 32	38 17	...	...	...	...	...	...	...	...	...	...	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	13.97	15.95	18.59	22.28	...	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	1.145 20	1.202 76	1.269 28	1.347 92	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	11	9	8	7	5	4	3	1	0	1	4	5	Minutes
Meridian	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	5 48	4 49	4 06	3 35	3 10	2 51	2 34	2 20	2 09	1 59	1 50	4
8	...	23 12	19 15	16 27	14 20	12 41	11 21	10 17	9 23	8 37	7 57	7 22	8
12	...	...	...	36 59	32 14	28 32	25 33	23 08	21 06	19 22	17 53	16 37	12
16	...	...	...	...	...	...	45 27	41 08	37 30	34 26	31 47	29 31	16
20	...	...	...	...	...	...	...	...	...	53 48	49 40	46 08	20
24	...	...	...	...	...	...	...	...	...	...	...	66 26	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	21.74	18.05	15.41	13.43	11.89	10.65	9.64	8.79	8.07	7.45	6.92	$\triangle_1 h$
Log.	... ...	1.337 26	1.256 48	1.187 80	1.128 08	1.075 18	1.027 35	0.984 08	0.943 99	0.906 87	0.872 16	0.840 11	Log.
Limit	7	8	9	11	12	13	14	15	17	18	19	20	Minutes
Meridian	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 43	1 36	1 31	1 25	1 20	1 16	1 12	1 08	1 05	1 02	0 59	0 56	4
8	6 53	6 26	6 02	5 40	5 21	5 04	4 48	4 34	4 19	4 07	3 55	3 45	8
12	15 28	14 28	13 35	12 46	12 03	11 24	10 48	10 15	9 43	9 16	8 50	8 25	12
16	27 28	25 44	24 09	22 42	21 25	20 16	19 12	18 13	17 17	16 28	15 42	14 59	16
20	42 56	40 12	37 44	35 28	33 28	31 40	30 00	28 28	27 00	25 44	24 32	23 24	20
24	61 49	57 54	54 21	51 05	48 12	45 36	43 12	40 59	38 53	37 04	35 20	33 42	24
28	84 09	78 48	73 57	69 31	65 36	62 02	58 48	55 48	52 55	50 26	48 05	45 52	28
32	...	...	...	...	...	81 04	76 48	72 53	69 07	65 52	62 48	59 54	32
36	...	...	...	...	...	...	...	...	...	...	79 30	75 49	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	6.44	6.03	5.66	5.32	5.02	4.75	4.50	4.27	4.05	3.86	3.68	3.51	$\Delta_1 h$
Log.	0.808 89	0.780 32	0.752 82	0.725 91	0.700 70	0.676 69	0.653 21	0.630 43	0.607 46	0.586 59	0.565 85	0.545 31	Log.
Limit	21	22	23	24	25	26	27	28	29	30	31	32	Minutes
Meridian	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 54	0 51	0 49	0 46	0 45	0 43	0 41	0 39	0 38	0 36	0 35	0 34	4
8	3 34	3 25	3 16	3 07	3 00	2 52	2 45	2 39	2 32	2 26	2 20	2 15	8
12	8 02	7 41	7 21	7 02	6 44	6 27	6 12	5 58	5 43	5 29	5 15	5 03	12
16	14 18	13 39	13 03	12 30	12 00	11 29	11 00	10 34	10 09	9 43	9 21	9 01	16
20	22 20	21 20	20 24	19 32	18 44	17 56	17 12	16 32	15 52	15 12	14 31	14 04	20
24	32 10	30 43	29 23	28 07	26 59	25 50	24 46	23 48	22 51	21 53	21 02	20 16	24
28	43 46	41 49	39 59	38 18	36 43	35 09	33 43	32 25	31 06	29 48	28 37	27 34	28
32	57 10	54 37	52 13	50 01	47 57	45 54	44 02	42 20	40 37	38 55	37 22	36 00	32
36	72 22	69 07	66 06	63 17	60 42	58 07	55 44	53 34	51 25	49 15	47 19	45 35	36
40	89 20	85 20	81 36	78 08	74 56	71 44	68 48	66 08	63 28	60 48	58 24	56 16	40
44	...	...	...	...	...	86 48	83 15	80 01	76 48	73 34	70 40	68 05	44
48	...	...	...	...	...	...	...	95 14	91 23	87 33	84 05	81 01	48
52	...	...	...	...	...	...	...	...	107 15	102 45	98 41	95 05	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	3.35	3.20	3.06	2.93	2.81	2.69	2.58	2.48	2.38	2.28	2.19	2.11	$\Delta_1 h$
Log.	0.525 04	0.505 15	0.485 72	0.466 87	0.448 71	0.429 75	0.411 62	0.394 45	0.376 58	0.357 93	0.340 44	0.324 28	Log.
Limit	33	34	35	36	37	38	39	40	41	42	43	44	Minutes
Meridian	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	Altitudes

Latitude 8° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 32	0 31	0 30	0 28	0 27	0 27	0 25	0 24	0 23	0 22	0 22	0 20	4
8	2 09	2 04	2 00	1 55	1 50	1 45	1 42	1 37	1 34	1 30	1 26	1 23	8
12	4 51	4 40	4 29	4 18	4 08	3 57	3 49	3 39	3 31	3 22	3 14	3 06	12
16	8 37	8 16	7 59	7 38	7 20	7 03	6 47	6 29	6 13	5 58	5 46	5 30	16
20	13 28	12 56	12 28	11 56	11 28	11 00	10 36	10 08	9 44	9 20	9 00	8 36	20
24	19 24	18 37	17 57	17 11	16 31	15 51	15 16	14 36	14 01	13 26	12 58	12 23	24
28	26 24	25 21	24 26	23 24	22 29	21 33	20 47	19 52	19 05	18 18	17 38	16 52	28
32	34 28	33 07	31 55	30 33	29 21	28 09	27 08	25 56	24 55	23 54	23 02	22 01	32
36	43 38	41 54	40 24	38 40	37 09	35 39	34 21	32 50	31 32	30 14	29 10	27 52	36
40	53 52	51 44	49 52	47 44	45 52	44 00	42 24	40 32	38 56	37 20	36 00	34 24	40
44	65 11	62 35	60 21	57 45	55 30	53 15	51 18	49 03	47 06	45 10	43 34	41 37	44
48	77 34	74 30	71 48	68 42	66 01	63 21	61 03	58 22	56 04	53 46	51 50	49 32	48
52	91 02	87 26	84 16	80 40	77 31	74 21	71 39	68 30	65 48	63 06	60 50	58 08	52
56	105 35	101 23	97 45	93 33	89 54	86 15	83 06	79 27	76 18	73 10	70 34	67 25	56
60	...	...	112 12	107 24	103 12	99 00	95 24	91 12	87 36	84 00	81 00	77 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.02	1.94	1.87	1.79	1.72	1.65	1.59	1.52	1.46	1.40	1.35	1.29	$\triangle_1$h
Log.	0.305 35	0.287 80	0.271 84	0.252 85	0.235 53	0.217 48	0.201 40	0.181 84	0.164 35	0.146 13	0.130 33	0.110 59	Log.
Limit	45	46	47	48	49	50	52	53	55	56	58	59	Minutes
Meridian	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 13	0 13	0 12	0 11	4
8	1 19	1 15	1 12	1 09	1 06	1 02	0 59	0 56	0 54	0 51	0 48	0 45	8
12	2 57	2 50	2 42	2 36	2 28	2 22	2 14	2 07	2 01	1 55	1 48	1 41	12
16	5 15	5 02	4 50	4 36	4 24	4 10	3 58	3 45	3 35	3 25	3 12	2 59	16
20	8 12	7 52	7 32	7 12	6 52	6 32	6 12	5 52	5 36	5 20	5 00	4 40	20
24	11 48	11 20	10 51	10 22	9 53	9 24	8 55	8 27	8 04	7 41	7 12	6 43	24
28	16 05	15 25	14 46	14 07	13 28	12 49	12 10	11 30	10 58	10 27	9 48	9 09	28
32	21 00	20 08	19 17	18 26	17 35	16 44	15 53	15 01	14 20	13 39	12 48	11 57	32
36	26 34	25 30	24 25	23 20	22 15	21 10	20 05	19 01	18 09	17 17	16 12	15 07	36
40	32 48	31 28	30 08	28 48	27 28	26 08	24 48	23 28	22 24	21 20	20 00	18 40	40
44	39 41	38 05	36 28	34 51	33 14	31 37	30 00	28 24	27 06	25 49	24 12	22 35	44
48	47 14	45 18	43 23	41 28	39 33	37 38	35 43	33 47	32 15	30 43	28 46	26 51	48
52	55 26	53 10	50 55	48 40	46 25	44 10	41 55	39 39	37 51	36 03	33 48	31 33	52
56	64 17	61 41	59 04	56 27	53 50	51 13	48 36	46 00	43 54	41 49	39 12	26 35	56
60	73 48	70 48	67 48	64 48	61 48	58 48	55 48	52 48	50 24	48 00	45 00	42 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.23	1.18	1.13	1.08	1.03	0.98	0.93	0.88	0.84	0.80	0.75	0.70	$\triangle_1$h
Log.	0.089 91	0.071 88	0.053 08	0.033 42	0.012 84	9.991 23	9.968 48	9.944 48	9.924 28	9.903 09	9.875 06	9.845 10	Log.
Limit	62	64	66	68	70	72	74	76	78	80	82	84	Minutes
Meridian	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 43	3 19	2 59	2 43	2 29	2 18	2 07	1 59	1 51	1 45	1 39	1 34	4
8	14 54	13 16	11 56	10 51	9 57	9 11	8 31	7 58	7 27	7 01	6 37	6 15	8
12	33 32	29 50	26 51	24 26	22 23	20 39	19 11	17 55	16 47	15 46	14 53	14 04	12
16	...	...	...	43 26	39 49	36 45	34 05	31 49	29 49	28 02	26 27	25 00	16
20	...	...	...	...	...	57 24	53 16	49 44	46 36	43 48	41 20	39 04	20
24	...	...	...	...	...	...	...	...	...	63 04	59 31	56 16	24
28	...	...	...	...	...	...	...	...	...	...	81 01	76 34	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	....	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	13.97	12.43	11.19	10.18	9.33	8.61	7.99	7.46	6.99	6.57	6.20	5.86	$\Delta_1 h$
Log.	1.145 20	1.094 47	1.048 83	1.007 75	0.969 88	0.935 00	0.902 55	0.872 74	0.844 48	0.817 57	0.792 39	0.767 90	Log.
Limit	10	12	13	14	15	16	17	18	19	20	21	22	Minutes
Meridian	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 29	1 24	1 21	1 17	1 14	1 10	1 07	1 05	1 02	1 00	0 58	0 55	4
8	5 56	5 39	5 23	5 08	4 54	4 42	4 30	4 19	4 09	4 00	3 51	3 43	8
12	13 21	12 42	12 06	11 32	11 02	10 34	10 08	9 43	9 20	8 59	8 39	8 22	12
16	23 43	22 34	21 30	20 32	19 38	18 46	18 00	17 17	16 36	15 57	15 25	14 50	16
20	37 04	35 16	33 36	32 04	30 40	29 20	28 08	27 00	25 56	24 56	24 04	23 12	20
24	53 23	50 47	48 23	46 11	44 10	42 14	40 31	38 53	37 21	35 54	34 40	33 24	24
28	72 39	69 08	65 51	62 51	60 06	57 30	55 09	52 55	50 50	48 52	47 10	45 29	28
32	...	...	...	82 05	78 30	75 06	72 01	69 07	66 23	63 50	61 36	59 24	32
36	...	...	...	...	...	...	...	...	...	...	77 59	75 10	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	5.56	5.29	5.04	4.81	4.60	4.40	4.22	4.05	3.89	3.74	3.61	3.48	$\Delta_1 h$
Log.	0.745 07	0.723 46	0.702 43	0.682 15	0.662 76	0.643 45	0.625 31	0.607 46	0.589 95	0.572 87	0.557 51	0.541 58	Log.
Limit	23	24	25	26	26	27	28	29	30	31	32	33	Minutes
Meridian	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	Altitudes

Latitude 8° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 54	0 52	0 50	0 48	0 46	0 45	0 44	0 43	0 41	0 39	0 38	0 38	4
8	3 34	3 28	3 20	3 13	3 06	3 01	2 56	2 49	2 45	2 40	2 35	2 30	8
12	8 02	7 47	7 30	7 15	7 01	6 47	6 35	6 21	6 10	5 59	5 47	5 37	12
16	14 18	13 49	13 22	12 53	12 27	12 05	11 41	11 19	10 58	10 37	10 17	9 59	16
20	22 20	21 36	20 52	20 08	19 28	18 52	18 16	17 40	17 08	16 36	16 04	15 36	20
24	32 10	31 06	30 03	29 00	28 02	27 10	26 18	25 27	24 40	23 54	23 08	22 28	24
28	43 46	42 20	40 54	39 28	38 10	36 59	35 48	34 37	33 35	32 33	31 30	30 34	28
32	57 10	55 18	53 25	51 32	49 50	48 18	46 46	45 13	43 52	42 30	41 08	39 56	32
36	72 22	69 59	67 37	65 14	63 04	61 08	59 11	57 15	55 31	53 47	52 03	50 33	36
40	89 20	86 24	83 28	80 32	77 52	75 28	73 04	70 40	68 32	66 24	64 16	62 24	40
44	...	...	...	...	...	...	88 24	85 31	82 56	80 20	77 45	75 30	44
48	...	...	...	...	...	...	...	...	...	95 37	92 33	89 51	48
52	...	...	...	...	...	...	...	...	...	...	...	105 27	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.35	3.24	3.13	3.02	2.92	2.83	2.74	2.65	2.57	2.49	2.41	2.34	$\triangle_1$h
Log.	0.525 04	0.510 55	0.495 54	0.480 01	0.465 38	0.451 79	0.437 75	0.423 25	0.409 93	0.396 20	0.382 02	0.369 22	Log.
Limit	34	35	36	37	38	38	39	40	41	42	43	43	Minutes
Meridian	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 36	0 35	0 34	0 33	0 32	0 31	0 30	0 29	0 28	0 27	0 27	0 26	4
8	2 25	2 21	2 16	2 13	2 08	2 04	2 01	1 57	1 54	1 50	1 47	1 43	8
12	5 26	5 17	5 06	4 58	4 48	4 40	4 32	4 23	4 16	4 08	4 00	3 53	12
16	9 38	9 23	9 06	8 50	8 32	8 16	8 04	7 49	7 33	7 20	7 08	6 55	16
20	15 04	14 40	14 12	13 48	13 20	12 56	12 36	12 12	11 48	11 28	11 08	10 48	20
24	21 42	21 07	20 27	19 52	19 12	18 37	18 09	17 34	16 59	16 31	16 02	15 34	24
28	29 32	28 45	27 50	27 03	26 08	25 21	24 42	23 55	23 08	22 29	21 49	21 10	28
32	38 34	37 33	36 21	35 20	34 08	33 07	32 15	31 13	30 13	29 21	28 30	27 38	32
36	48 49	47 31	46 01	44 43	43 12	41 54	40 50	39 32	38 14	37 09	36 05	35 00	36
40	60 16	58 40	56 48	55 12	53 20	51 44	50 24	48 48	47 12	45 52	44 32	43 12	40
44	72 55	70 59	68 44	66 48	64 32	62 35	60 59	59 03	57 07	55 30	53 54	52 17	44
48	86 47	84 29	81 46	79 29	76 48	74 30	72 34	70 16	67 56	66 01	64 07	62 12	48
52	101 57	99 09	95 59	93 17	90 08	87 26	85 10	82 28	79 46	77 31	75 15	73 00	52
56	...	...	...	108 12	104 32	101 23	98 47	95 39	92 31	89 54	87 18	84 41	56
60	...	...	...	...	...	...	113 24	109 48	106 12	103 12	100 12	97 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.26	2.20	2.13	2.07	2.00	1.94	1.89	1.83	1.77	1.72	1.67	1.62	$\triangle_1$h
Log.	0.354 11	0.342 42	0.328 38	0.315 97	0.301 03	0.287 80	0.276 46	0.262 45	0.247 97	0.235 53	0.222 72	0.209 52	Log.
Limit	44	45	46	46	47	48	49	50	51	52	53	54	Minutes
Meridian	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 24	0 23	0 22	0 22	0 22	0 20	0 20	0 19	0 19	0 18	0 17	4
8	1 41	1 37	1 34	1 31	1 28	1 26	1 23	1 20	1 17	1 15	1 12	1 10	8
12	3 46	3 39	3 32	3 25	3 19	3 13	3 06	3 00	2 54	2 48	2 42	2 37	12
16	6 42	6 29	6 16	6 03	5 53	5 43	5 30	5 20	5 10	5 00	4 50	4 39	16
20	10 28	10 08	9 48	9 28	9 12	8 56	8 36	8 20	8 04	7 48	7 32	7 16	20
24	15 04	14 36	14 06	13 38	13 15	12 52	12 23	12 00	11 37	11 14	10 51	10 28	24
28	20 31	19 52	19 13	18 34	18 02	17 30	16 52	16 20	15 49	15 17	14 46	14 15	28
32	26 48	25 56	25 06	24 14	23 33	22 52	22 01	21 20	20 39	19 58	19 17	18 36	32
36	33 55	32 50	31 45	30 40	29 49	28 57	27 52	27 00	26 08	25 17	24 25	23 33	36
40	41 52	40 32	39 12	37 52	36 48	35 44	34 24	33 20	32 16	31 12	30 08	29 04	40
44	50 40	49 03	47 26	45 49	44 32	43 14	41 37	40 20	39 02	37 46	36 28	35 10	44
48	60 17	58 22	56 27	54 32	52 59	51 27	49 32	48 00	46 28	44 55	43 23	41 51	48
52	70 45	68 30	66 15	64 00	62 11	60 23	58 08	56 20	54 32	52 43	50 55	49 07	52
56	82 04	79 27	76 50	74 13	72 08	70 02	67 25	65 20	63 14	61 10	59 04	56 58	56
60	94 12	91 12	88 12	85 12	82 48	80 24	77 24	75 00	72 36	70 12	67 48	65 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.57	1.52	1.47	1.42	1.38	1.34	1.29	1.25	1.21	1.17	1.13	1.09	$\Delta_1 h$
Log.	0.195 90	0.181 84	0.167 32	0.152 29	0.139 88	0.127 10	0.110 59	0.096 91	0.082 79	0.068 19	0.053 08	0.037 43	Log.
Limit	55	57	58	59	60	62	64	66	67	69	71	73	Minutes
Meridian	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 16	0 15	0 14	0 14	0 14	0 13	0 12	0 12	0 11	0 11	0 11	4
8	1 07	1 04	1 02	0 59	0 57	0 55	0 52	0 50	0 48	0 45	0 43	0 41	8
12	2 31	2 25	2 20	2 14	2 10	2 04	1 58	1 52	1 48	1 42	1 37	1 33	12
16	4 29	4 19	4 08	3 58	3 50	3 40	3 30	3 19	3 12	3 02	2 54	2 47	16
20	7 00	6 44	6 28	6 12	6 00	5 44	5 28	5 12	5 00	4 44	4 32	4 20	20
24	10 05	9 42	9 18	8 55	8 38	8 16	7 53	7 29	7 12	6 49	6 32	6 15	24
28	13 43	13 12	12 41	12 10	11 46	11 14	10 43	10 12	9 48	9 17	8 53	8 29	28
32	17 55	17 14	16 34	15 53	15 22	14 40	13 59	13 19	12 48	12 07	11 36	11 05	32
36	22 41	21 49	20 57	20 05	19 26	18 35	17 43	16 51	16 12	15 20	14 42	14 03	36
40	28 00	26 56	25 52	24 48	24 00	22 56	21 52	20 48	20 00	18 56	18 08	17 20	40
44	33 53	32 35	31 18	30 00	29 02	27 45	26 28	25 10	24 12	22 54	21 57	20 59	44
48	40 19	38 47	37 15	35 43	34 34	33 01	31 29	29 55	28 46	27 14	26 06	24 57	48
52	47 19	45 31	43 43	41 55	40 34	38 45	36 57	35 09	33 48	32 00	30 38	29 17	52
56	54 53	52 47	50 42	48 36	47 02	44 57	42 52	40 46	39 12	37 06	35 33	33 59	56
60	63 00	60 36	58 12	55 48	54 00	51 36	49 12	46 48	45 00	42 36	40 48	39 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.05	1.01	0.97	0.93	0.90	0.86	0.82	0.78	0.75	0.71	0.68	0.65	$\Delta_1 h$
Log.	0.021 19	0.004 32	9.986 77	9.968 48	9.954 24	9.934 50	9.913 81	9.892 09	9.875 06	9.851 26	9.832 51	9.812 91	Log.
Limit	74	75	76	77	78	80	82	84	86	88	90	92	Minutes
Meridian	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	Altitudes

Latitude 9° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 18	3 43	4 14	4 57	5 55	...	...	...	...	...	...	...	4
8	13 14	14 51	16 57	19 46	23 41	...	...	...	...	...	...	...	8
12	29 46	33 26	38 10	...	...	...	...	...	...	...	...	...	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	12.40	13.93	15.90	18.53	22.20	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	1.093 42	1.143 95	1.201 40	1.267 88	1.346 35	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	12	10	9	8	7	6	5	3	1	0	2	4	Minutes
Meridian	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	5 45	4 46	4 05	3 34	3 08	2 49	2 33	2 19	2 07	1 58	4
8	...	...	23 02	19 06	16 19	14 13	12 35	11 16	10 11	9 18	8 31	7 52	8
12	...	...	...	...	36 43	31 59	28 18	25 21	22 55	20 54	19 11	17 43	12
16	...	...	...	...	...	...	...	45 03	40 45	37 10	34 05	31 29	16
20	...	...	...	...	...	...	...	...	...	58 04	53 16	49 12	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	21.59	17.92	15.30	13.33	11.79	10.56	9.55	8.71	7.99	7.38	$\triangle_1 h$
Log.	... ...	... ...	1.334 25	1.253 34	1.184 69	1.124 83	1.071 51	1.023 66	0.980 00	0.940 02	0.902 55	0.868 06	Log.
Limit	6	7	8	9	11	12	13	14	16	17	18	19	Minutes
Meridian	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	Altitudes

Latitude 9° Declination Same Name.

Declinations.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 50	1 42	1 35	1 29	1 24	1 19	1 15	1 11	1 07	1 04	1 01	0 58	4
8	7 18	6 48	6 21	5 58	5 37	5 17	5 00	4 45	4 30	4 16	4 03	3 51	8
12	16 26	15 19	14 19	13 25	12 38	11 55	11 15	10 40	10 06	9 36	9 07	8 41	12
16	29 14	27 13	25 25	23 51	22 26	21 09	20 01	18 56	17 58	17 04	16 13	15 27	16
20	45 40	42 32	39 44	37 16	35 04	33 04	31 16	29 36	28 04	26 40	25 20	24 08	20
24	65 46	61 15	57 13	53 40	50 30	47 37	45 02	42 37	40 25	38 24	36 29	34 46	24
28	. . .	83 23	77 53	73 01	68 44	64 49	61 17	58 01	55 01	52 16	49 39	47 18	28
32	. . .	. . .	. . .	. . .	. . .	. . .	80 00	75 47	71 51	68 16	64 51	61 46	32
36	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	78 12	36
40	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	40
44	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	44
48	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	48
52	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	52
56	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	56
60	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.85	6.38	5.96	5.59	5.26	4.96	4.69	4.44	4.21	4.00	3.80	3.62	$\triangle_1 h$
Log.	0.835 69	0.804 82	0.775 25	0.747 41	0.720 99	0.695 48	0.671 17	0.647 38	0.624 28	0.602 06	0.579 78	0.558 71	Log.
Limit	20	21	22	23	24	25	26	27	28	29	30	32	Minutes
Meridian	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	Altitudes

Declinations.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 55	0 53	0 51	0 48	0 46	0 44	0 43	0 41	0 38	0 37	0 36	0 35	4
8	3 42	3 31	3 21	3 13	3 04	2 57	2 49	2 43	2 36	2 29	2 24	2 17	8
12	8 19	7 55	7 33	7 13	6 55	6 38	6 21	6 06	5 50	5 35	5 23	5 09	12
16	14 45	14 05	13 27	12 51	12 17	11 46	11 19	10 50	10 22	9 57	9 33	9 11	16
20	23 04	22 00	21 00	20 04	19 12	18 24	17 40	16 56	16 12	15 32	14 56	14 20	20
24	33 13	31 41	30 15	28 54	27 39	26 30	25 27	24 23	23 19	22 22	21 30	20 39	24
28	45 13	43 07	41 09	39 20	37 38	36 04	34 37	33 11	31 46	30 27	29 16	28 05	28
32	59 03	56 19	53 45	51 22	49 09	47 06	45 13	43 21	41 29	39 46	38 14	36 41	32
36	74 44	71 17	68 03	65 01	62 13	59 37	57 15	54 52	52 29	50 20	48 23	46 27	36
40	92 16	88 00	84 00	80 16	76 48	73 36	70 40	67 44	64 48	62 08	59 44	57 20	40
44	. . .	. . .	. . .	. . .	. . .	. . .	85 31	81 57	78 24	75 11	72 16	69 23	44
48	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	93 19	89 28	86 01	82 33	48
52	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	105 00	100 57	96 53	52
56	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	56
60	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.46	3.30	3.15	3.01	2.88	2.76	2.65	2.54	2.43	2.33	2.24	2.15	$\triangle_1 h$
Log.	0.539 08	0.518 51	0.498 31	0.478 57	0.459 39	0.440 91	0.423 25	0.404 83	0.385 61	0.367 36	0.350 25	0.332 44	Log.
Limit	33	34	35	36	37	38	39	40	41	42	42	43	Minutes
Meridian	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	Altitudes

Latitude 9° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 33	0 31	0 30	0 29	0 28	0 27	0 26	0 25	0 23	0 22	0 22	0 21	4
8	2 12	2 06	2 01	1 56	1 52	1 47	1 42	1 39	1 35	1 31	1 27	1 23	8
12	4 57	4 46	4 34	4 22	4 12	4 02	3 51	3 43	3 34	3 25	3 16	3 07	12
16	8 47	8 26	8 06	7 46	7 28	7 10	6 53	6 37	6 18	6 03	5 48	5 33	16
20	13 44	13 12	12 40	12 08	11 40	11 12	10 44	10 20	9 52	9 28	9 04	8 40	20
24	19 47	19 00	18 14	17 29	16 48	16 08	15 28	14 53	14 12	13 38	13 04	12 29	24
28	26 55	25 53	24 50	23 47	22 52	21 57	21 02	20 15	19 21	18 34	17 46	16 59	28
32	35 09	33 48	32 26	31 03	29 52	28 40	27 28	26 27	25 16	24 14	23 12	22 11	32
36	44 30	42 46	41 02	39 19	37 48	36 18	34 47	33 29	31 58	30 40	29 23	28 05	36
40	54 56	52 48	50 40	48 32	46 40	44 48	42 56	41 20	39 28	37 52	36 16	34 40	40
44	66 28	63 53	61 18	58 44	56 28	54 13	51 57	50 01	47 45	45 49	43 53	41 57	44
48	79 06	76 02	72 58	69 53	67 10	64 30	61 49	59 31	56 50	54 32	52 13	49 55	48
52	92 50	89 14	85 38	82 01	78 52	75 42	72 33	69 51	66 42	64 00	61 17	58 35	52
56	107 41	103 29	99 18	95 08	91 28	87 49	84 09	81 01	77 21	74 13	71 05	67 57	56
60	. . .	. . .	114 00	109 12	105 00	100 48	96 36	93 00	88 48	85 12	81 36	78 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.06	1.98	1.90	1.82	1.75	1.68	1.61	1.55	1.48	1.42	1.36	1.30	$\triangle_1$h
Log.	0.313 87	0.296 67	0.278 75	0.260 07	0.243 04	0.225 31	0.206 83	0.190 33	0.170 26	0.152 29	0.133 54	0.113 94	Log.
Limit	44	45	46	48	49	51	52	53	54	55	57	59	Minutes
Meridian	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41•	40°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 19	0 19	0 17	0 17	0 15	0 15	0 14	0 14	0 13	0 12	0 11	4
8	1 20	1 16	1 13	1 10	1 07	1 03	1 00	0 57	0 54	0 51	0 49	0 46	8
12	3 00	2 51	2 44	2 37	2 30	2 23	2 16	2 08	2 02	1 55	1 50	1 44	12
16	5 20	5 05	4 52	4 39	4 26	4 13	4 00	3 48	3 38	3 25	3 14	3 04	16
20	8 20	7 56	7 36	7 16	6 56	6 36	6 16	5 56	5 40	5 20	5 04	4 48	20
24	12 00	11 26	10 57	10 28	9 59	9 30	9 01	8 33	8 10	7 41	7 18	6 55	24
28	16 20	15 33	14 53	14 15	13 35	12 57	12 17	11 38	11 06	10 27	9 56	9 25	28
32	21 20	20 18	19 27	18 36	17 45	16 54	16 03	15 11	14 30	13 39	12 58	12 17	32
36	27 00	25 43	24 38	23 33	22 28	21 23	20 18	19 14	18 22	17 17	16 25	15 33	36
40	33 20	31 44	30 24	29 04	27 44	26 24	25 04	23 44	22 40	21 20	20 16	19 12	40
44	40 20	38 24	36 47	35 10	33 33	31 56	30 19	28 43	27 26	25 49	24 31	23 14	44
48	48 00	45 41	43 46	41 51	39 56	38 01	36 06	34 10	32 38	30 43	29 09	27 37	48
52	56 20	53 37	51 22	49 07	46 52	44 37	42 22	40 06	38 18	36 03	34 15	32 27	52
56	65 20	62 12	59 35	56 58	54 21	51 44	49 07	46 31	44 26	41 49	39 43	37 38	56
60	75 00	71 24	68 24	65 24	62 24	59 24	56 24	53 24	51 00	48 00	45 36	43 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.25	1.19	1.14	1.09	1.04	0.99	0.94	0.89	0.85	0.80	0.76	0.72	$\triangle_1$h
Log.	0.096 91	0.075 55	0.056 90	0.037 43	0.017 03	9.995 64	9.973 13	9.949 39	9.929 42	9.903 09	9.880 81	9.857 33	Log.
Limit	61	63	65	67	69	71	73	75	77	79	81	83	Minutes
Meridian	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	Altitudes

Latitude 9° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 18	2 59	2 43	2 29	2 18	2 07	1 59	1 51	1 45	1 39	1 34	1 29	4
8	13 14	11 55	10 50	9 56	9 10	8 31	7 57	7 26	7 01	6 37	6 16	5 57	8
12	29 46	26 48	24 23	22 20	20 38	19 11	17 53	16 46	15 46	14 53	14 05	13 22	12
16	...	...	43 21	39 44	36 42	34 05	31 47	29 46	28 02	26 27	25 03	23 46	16
20	...	...	...	...	57 20	53 16	49 40	46 32	43 48	41 20	39 08	37 08	20
24	...	...	...	...	...	...	...	...	63 04	59 31	56 21	53 28	24
28	...	...	...	...	...	...	...	...	...	81 01	76 42	72 47	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	12.40	11.17	10.16	9.31	8.60	7.99	7.45	6.98	6.57	6.20	5.87	5.57	$\triangle_1 h$
Log.	1.093 42	1.048 05	1.006 89	0.968 95	0.934 50	0.902 55	0.872 16	0.843 86	0.817 57	0.792 39	0.768 64	0.745 86	Log.
Limit	12	13	14	15	16	17	18	19	20	21	22	23	Minutes
Meridian	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 24	1 21	1 17	1 14	1 10	1 07	1 05	1 02	1 00	0 58	0 55	0 54	4
8	5 39	5 23	5 08	4 55	4 43	4 31	4 20	4 10	4 01	3 51	3 44	3 36	8
12	12 42	12 06	11 34	11 03	10 35	10 09	9 45	9 23	9 02	8 41	8 23	8 05	12
16	22 34	21 30	20 34	19 41	18 49	18 03	17 19	16 41	16 02	15 27	14 53	14 23	16
20	35 16	33 36	32 08	30 44	29 24	28 12	27 04	26 04	25 04	24 08	23 16	22 28	20
24	50 47	48 23	46 17	44 16	42 20	40 36	38 59	37 32	36 06	34 46	33 30	32 21	24
28	69 08	65 51	62 59	60 14	57 38	55 17	53 03	51 06	49 08	47 18	45 37	44 02	28
32	...	...	82 15	78 40	75 16	72 12	69 17	66 44	64 10	61 46	59 34	57 31	32
36	...	...	...	...	...	...	...	...	...	78 12	75 23	72 48	36
40	...	...	...	...	...	...	...	...	...	...	...	89 52	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.29	5.04	4.82	4.61	4.41	4.23	4.06	3.91	3.76	3.62	3.49	3.37	$\triangle_1 h$
Log.	0.723 46	0.702 43	0.683 05	0.663 70	0.644 44	0.626 34	0.608 53	0.592 18	0.575 19	0.558 71	0.542 83	0.527 63	Log.
Limit	24	25	26	26	27	28	29	30	31	32	33	34	Minutes
Meridian	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	Altitudes

Latitude 9° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 52	0 51	0 49	0 47	0 46	0 44	0 43	0 41	0 40	0 38	0 38	0 36	4
8	3 28	3 21	3 15	3 08	3 02	2 57	2 51	2 46	2 41	2 36	2 31	2 27	8
12	7 48	7 32	7 18	7 04	6 50	6 38	6 24	6 13	6 01	5 50	5 40	5 30	12
16	13 52	13 24	12 58	12 32	12 10	11 46	11 24	11 03	10 43	10 22	10 04	9 46	16
20	21 40	20 56	20 16	19 36	19 00	18 24	17 48	17 16	16 44	16 12	15 44	15 16	20
24	31 12	30 09	29 11	28 13	27 22	26 30	25 38	24 52	24 06	23 19	22 40	21 59	24
28	42 28	41 01	39 43	38 25	37 14	36 04	34 53	33 51	32 48	31 46	30 50	29 56	28
32	55 28	53 35	51 53	50 11	48 38	47 06	45 34	44 12	42 50	41 29	40 16	39 05	32
36	70 12	67 50	65 40	63 30	61 34	59 37	57 41	55 57	54 13	52 29	50 59	49 28	36
40	86 40	83 44	81 04	78 24	76 00	73 36	71 12	69 04	66 56	64 48	62 56	61 04	40
44	...	...	...	...	...	...	86 10	83 34	80 59	78 24	76 09	73 53	44
48	...	...	...	...	...	...	...	...	96 23	93 19	90 37	87 56	48
52	...	...	...	...	...	...	...	...	...	...	106 21	103 12	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△ h	3.25	3.14	3.04	2.94	2.85	2.76	2.67	2.59	2.51	2.43	2.36	2.29	$\triangle_1$h
Log.	0.511 88	0.496 93	0.482 87	0.468 35	0.454 84	0.440 91	0.426 51	0.413 30	0.399 67	0.385 61	0.372 91	0.359 84	Log.
Limit	35	35	36	37	38	39	40	40	41	42	43	44	Minutes
Meridian	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 35	0 33	0 32	0 31	0 30	0 30	0 29	0 28	0 27	0 27	0 26	4
8	2 22	2 17	2 14	2 10	2 05	2 02	1 58	1 55	1 52	1 49	1 45	1 42	8
12	5 20	5 09	5 01	4 52	4 44	4 35	4 26	4 19	4 12	4 05	3 56	3 50	12
16	9 28	9 11	8 55	8 40	8 24	8 09	7 54	7 41	7 28	7 15	7 00	6 50	16
20	14 48	14 20	13 56	13 32	13 08	12 44	12 20	12 00	11 40	11 20	10 56	10 40	20
24	21 19	20 39	20 04	19 29	18 54	18 20	17 46	17 17	16 48	16 19	15 45	15 22	24
28	29 01	28 05	27 19	26 32	25 45	24 58	24 10	23 31	22 52	22 13	21 25	20 54	28
32	37 53	36 41	35 40	34 39	33 38	32 36	31 34	30 43	29 52	29 01	27 59	27 18	32
36	47 57	46 27	45 09	43 51	42 33	41 15	39 58	38 53	37 48	36 43	35 26	34 34	36
40	59 12	57 20	55 44	54 08	52 32	50 56	49 20	48 00	46 40	45 20	43 44	42 40	40
44	71 38	69 23	67 26	65 30	63 34	61 37	59 42	58 05	56 28	54 51	52 55	51 38	44
48	85 15	82 33	80 15	77 57	75 39	73 21	71 02	69 07	67 10	65 15	62 58	61 26	48
52	100 03	96 53	94 11	91 29	88 47	86 05	83 22	81 07	78 52	76 37	73 54	72 06	52
56	...	...	...	106 06	102 57	99 49	96 42	94 05	91 28	88 51	85 43	83 38	56
60	...	...	...	...	...	114 36	111 00	108 00	105 00	102 00	98 24	96 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.22	2.15	2.09	2.03	1.97	1.91	1.85	1.80	1.75	1.70	1.64	1.60	$\triangle_1$h
Log.	0.346 35	0.332 44	0.320 15	0.307 50	0.294 47	0.281 03	0.267 17	0.255 27	0.243 04	0.230 45	0.214 84	0.204 12	Log.
Limit	45	46	47	48	48	49	50	51	52	53	54	55	Minutes
Meridian	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 24	0 23	0 22	0 22	0 21	0 20	0 20	0 19	0 19	0 18	0 17	4
8	1 39	1 36	1 33	1 30	1 28	1 24	1 22	1 20	1 17	1 14	1 11	1 09	8
12	3 43	3 36	3 29	3 23	3 17	3 10	3 05	2 59	2 53	2 47	2 41	2 36	12
16	6 37	6 24	6 11	6 01	5 51	5 38	5 27	5 17	5 07	4 57	4 47	4 36	16
20	10 20	10 00	9 40	9 24	9 08	8 48	8 32	8 16	8 00	7 44	7 28	7 12	20
24	14 53	14 24	13 55	13 32	13 09	12 41	12 17	11 54	11 31	11 09	10 46	10 22	24
28	20 15	19 36	18 57	18 26	17 54	17 15	16 44	16 12	15 41	15 09	14 38	14 07	28
32	26 27	25 36	24 45	24 04	23 23	22 31	21 51	21 10	20 29	19 47	19 06	18 26	32
36	33 29	32 24	31 19	30 27	29 36	28 31	27 39	26 47	25 55	25 04	24 12	23 20	36
40	41 20	40 00	38 40	37 36	36 32	35 12	34 08	33 04	32 00	30 56	29 52	28 48	40
44	50 01	48 24	46 47	45 29	44 13	42 36	41 18	40 00	38 43	37 26	36 09	34 51	44
48	59 31	57 36	55 41	54 09	52 36	50 41	49 09	47 37	46 05	44 32	43 00	41 28	48
52	69 51	67 36	65 21	63 33	61 44	59 29	57 41	55 53	54 05	52 16	50 28	48 40	52
56	81 01	78 24	75 37	73 41	71 37	69 00	66 54	64 48	62 43	60 38	58 33	56 27	56
60	93 00	90 00	87 00	84 36	82 12	79 12	76 48	74 24	72 00	69 36	67 12	64 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.55	1.50	1.45	1.41	1.37	1.32	1.28	1.24	1.20	1.16	1.12	1.08	$\triangle_1 h$
Log.	0.190 33	0.176 09	0.161 37	0.149 22	0.136 72	0.120 57	0.107 21	0.093 42	0.079 18	0.064 46	0.049 22	0.033 42	Log.
Limit	56	58	59	60	61	63	65	67	68	70	72	74	Minutes
Meridian	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 16	0 15	0 14	0 14	0 14	0 13	0 12	0 12	0 11	0 11	0 11	4
8	1 07	1 04	1 01	0 59	0 57	0 54	0 52	0 50	0 47	0 45	0 43	0 41	8
12	2 30	2 24	2 19	2 14	2 08	2 02	1 58	1 52	1 47	1 42	1 37	1 33	12
16	4 26	4 16	4 05	3 58	3 48	3 38	3 30	3 19	3 09	3 02	2 54	2 47	16
20	6 56	6 40	6 24	6 12	5 56	5 40	5 28	5 12	4 56	4 44	4 32	4 20	20
24	9 59	9 36	9 13	8 55	8 33	8 10	7 53	7 29	7 06	6 49	6 32	6 15	24
28	13 35	13 04	12 33	12 10	11 38	11 06	10 43	10 12	9 40	9 17	8 53	8 29	28
32	17 45	17 04	16 23	15 53	15 11	14 30	13 59	13 19	12 38	12 07	11 36	11 05	32
36	22 28	21 36	20 44	20 05	19 14	18 22	17 43	16 51	15 59	15 20	14 42	14 03	36
40	27 44	26 40	25 36	24 48	23 44	22 40	21 52	20 48	19 44	18 56	18 08	17 20	40
41	33 33	32 16	30 58	30 00	28 43	27 26	26 28	25 10	23 52	22 54	21 57	20 59	44
48	39 56	38 24	36 52	35 43	34 10	32 38	31 29	29 55	28 23	27 14	26 06	24 57	48
52	46 52	45 04	43 16	41 55	40 06	38 18	36 57	35 09	33 21	32 00	30 38	29 17	52
56	54 21	52 16	50 10	48 36	46 31	44 26	42 52	40 46	38 40	37 06	35 33	33 59	56
60	62 24	60 00	57 36	55 48	53 24	51 00	49 12	46 48	44 24	42 36	40 48	39 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.04	1.00	0.96	0.93	0.89	0.85	0.82	0.78	0.74	0.71	0.68	0.65	$\triangle_1 h$
Log.	0.017 03	0.00 . . .	9.982 27	9.968 48	9.949 39	9.929 42	9.913 81	9.892 09	9.869 23	9.851 26	9.832 51	9.812 91	Log.
Limit	75	76	77	78	79	80	82	84	86	88	90	92	Minutes
Meridian	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	Altitudes

Latitude 10° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 59	3 18	3 42	4 14	4 55	5 54	...	...	...	...	...	...	4
8	11 53	13 11	14 49	16 54	19 41	23 34	...	...	...	...	...	...	8
12	26 44	29 40	33 20	38 01	...	...	...	...	...	...	...	...	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	11.14	12.36	13.89	15.84	18.45	22.10	...	...	...	...	...	...	$\triangle_1 h$
Log.	1.046 89	1.092 02	1.142 70	1.199 76	1.266 00	1.344 39	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	13	11	10	9	8	7	6	5	3	1	0	2	Minutes
Meridian	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	5 43	4 44	4 03	3 31	3 07	2 47	2 31	2 18	2 06	4
8	...	...	...	22 52	18 58	16 11	14 06	12 28	11 10	10 06	9 11	8 26	8
12	...	...	...	...	42 41	36 24	31 42	28 03	25 07	22 43	20 41	18 58	12
16	...	...	...	...	...	...	...	...	44 37	40 21	36 47	33 45	16
20	...	...	...	...	...	...	...	...	...	...	57 28	52 44	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	21.43	17.78	15.17	13.21	11.69	10.46	9.46	8.62	7.91	$\triangle_1 h$
Log.	... ...	... ...	... ...	1.331 02	1.249 93	1.180 99	1.120 90	1.067 81	1.019 53	0.975 89	0.935 51	0.898 18	Log.
Limit	4	6	7	8	10	11	12	13	15	16	17	18	Minutes
Meridian	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	Altitudes

Latitude 10° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 57	1 49	1 41	1 34	1 28	1 23	1 18	1 14	1 10	1 07	1 03	1 00	4
8	7 47	7 14	6 44	6 17	5 54	5 32	5 13	4 56	4 40	4 25	4 12	4 00	8
12	17 31	16 15	15 08	14 08	13 16	12 27	11 46	11 06	10 31	9 57	9 28	9 00	12
16	31 09	28 53	26 56	25 08	23 36	22 09	20 54	19 46	18 41	17 43	16 48	16 00	16
20	48 40	45 08	42 04	39 16	36 52	34 36	32 40	30 52	29 12	27 40	26 16	25 00	20
24	...	64 59	60 35	56 33	53 05	49 50	47 02	44 27	42 03	39 51	37 49	36 00	24
28	...	...	82 27	76 58	72 16	67 49	64 02	60 30	57 14	54 13	51 29	49 00	28
32	...	...	...	...	...	...	83 38	79 01	74 45	70 49	67 15	64 00	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	7.30	6.77	6.31	5.89	5.53	5.19	4.90	4.63	4.38	4.15	3.94	3.75	$\triangle_1$h
Log.	0.863 32	0.830 59	0.800 03	0.770 12	0.742 73	0.715 17	0.690 20	0.665 58	0.641 47	0.618 05	0.595 50	0.574 03	Log.
Limit	19	20	21	22	23	24	25	26	27	28	29	31	Minutes
Meridian	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 57	0 54	0 52	0 50	0 47	0 45	0 43	0 42	0 39	0 38	0 36	0 35	4
8	3 49	3 38	3 28	3 18	3 09	3 01	2 54	2 46	2 40	2 32	2 27	2 20	8
12	8 34	8 10	7 48	7 26	7 07	6 47	6 30	6 14	5 59	5 43	5 30	5 15	12
16	15 14	14 30	13 52	13 14	12 37	12 05	11 34	11 06	10 37	10 09	9 46	9 21	16
20	23 48	22 40	21 40	20 40	19 44	18 52	18 04	17 20	16 36	15 52	15 16	14 36	20
24	34 16	32 38	31 12	29 46	28 25	27 10	26 01	24 58	23 54	22 51	21 59	21 02	24
28	46 39	44 26	42 28	40 30	38 41	36 59	35 25	33 58	32 33	31 06	29 56	28 37	28
32	60 56	58 02	55 28	52 54	50 31	48 18	46 15	44 22	42 30	40 37	39 05	37 22	32
36	77 07	73 26	70 12	66 58	63 56	61 08	58 32	56 10	53 47	51 25	49 28	47 19	36
40	...	90 40	86 40	82 40	78 56	75 28	72 16	69 20	66 24	63 28	61 04	58 24	40
44	...	...	...	...	...	...	87 26	83 54	80 20	76 48	73 53	70 40	44
48	...	...	...	...	...	...	...	99 50	95 37	91 23	87 56	84 05	48
52	...	...	...	...	...	...	...	...	...	107 15	103 12	98 41	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.57	3.40	3.25	3.10	2.96	2.83	2.71	2.60	2.49	2.38	2.29	2.19	$\triangle_1$h
Log.	0.552 67	0.531 48	0.511 88	0.491 36	0.471 29	0.451 79	0.432 97	0.414 97	0.396 20	0.376 58	0.359 84	0.340 44	Log.
Limit	32	33	34	35	36	37	38	39	40	41	42	43	Minutes
Meridian	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	Altitudes

Latitude 10° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 34	0 32	0 30	0 30	0 28	0 27	0 27	0 25	0 24	0 22	0 22	0 21	4
8	2 14	2 09	2 03	1 58	1 54	1 50	1 45	1 41	1 36	1 33	1 28	1 24	8
12	5 02	4 51	4 38	4 26	4 17	4 06	3 56	3 46	3 36	3 28	3 19	3 10	12
16	8 58	8 37	8 14	7 54	7 35	7 18	7 00	6 42	6 24	6 08	5 53	5 38	16
20	14 00	13 28	12 52	12 20	11 52	11 24	10 56	10 28	10 00	9 36	9 12	8 48	20
24	20 10	19 24	18 31	17 46	17 05	16 25	15 45	15 04	14 24	13 49	13 15	12 41	24
28	27 26	26 24	25 14	24 10	23 16	22 21	21 25	20 31	19 36	18 49	18 02	17 15	28
32	35 50	34 28	32 57	31 34	30 23	29 11	27 59	26 48	25 36	24 35	23 33	22 31	32
36	45 22	43 38	41 41	39 58	38 27	36 56	35 26	33 55	32 24	31 06	29 49	28 31	36
40	56 00	53 52	51 28	49 20	47 28	45 36	43 44	41 52	40 00	38 24	36 48	35 12	40
44	67 46	65 11	62 16	59 42	57 26	55 10	52 55	50 40	48 24	46 27	44 32	42 36	44
48	80 38	77 34	74 07	71 02	68 19	65 38	62 58	60 17	57 36	55 18	52 59	50 41	48
52	94 38	91 02	86 59	83 22	80 13	77 04	73 54	70 45	67 36	64 54	62 11	59 29	52
56	. . .	105 35	100 52	96 42	93 02	89 22	85 43	82 04	78 24	75 15	72 08	69 00	56
60	. . .	. . .	. . .	111 00	106 48	102 36	98 24	94 12	90 00	86 24	82 48	79 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.10	2.02	1.93	1.85	1.78	1.71	1.64	1.57	1.50	1.44	1.38	1.32	$\triangle_1 h$
Log.	0.322 22	0.305 35	0.285 56	0.267 17	0.250 42	0.233 00	0.214 84	0.195 90	0.176 09	0.158 36	0.139 88	0.120 57	Log.
Limit	44	45	46	45	49	50	51	52	53	54	56	58	Minutes
Meridian	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 19	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 13	0 12	0 11	4
8	1 21	1 17	1 13	1 10	1 07	1 04	1 01	0 57	0 54	0 51	0 49	0 45	8
12	3 02	2 54	2 45	2 38	2 31	2 24	2 17	2 10	2 02	1 56	1 50	1 42	12
16	5 22	5 10	4 55	4 42	4 29	4 16	4 03	3 50	3 38	3 28	3 14	3 02	16
20	8 24	8 04	7 40	7 20	7 00	6 40	6 20	6 00	5 40	5 24	5 04	4 44	20
24	12 06	11 37	11 03	10 34	10 05	9 36	9 07	8 38	8 10	7 47	7 18	6 49	24
28	16 28	15 49	15 01	14 22	13 43	13 04	12 25	11 46	11 06	10 35	9 56	9 17	28
32	21 20	20 39	19 37	18 46	17 55	17 04	16 13	15 22	14 30	13 49	12 58	12 07	32
36	27 13	26 08	24 51	23 46	22 41	21 36	20 31	19 26	18 22	17 30	16 25	15 20	36
40	33 36	32 16	30 40	29 20	28 00	26 40	25 20	24 00	22 40	21 36	20 16	18 56	40
44	40 39	39 02	37 07	35 30	33 53	32 16	30 39	29 02	27 26	26 08	24 31	22 54	44
48	48 23	46 28	44 09	42 14	40 19	38 24	36 29	34 34	32 38	31 06	29 09	27 14	48
52	56 47	54 32	51 49	49 34	47 19	45 04	42 49	40 34	38 18	36 30	34 15	32 00	52
56	65 51	63 14	60 07	57 30	54 53	52 16	49 39	47 02	44 26	42 20	39 43	37 06	56
60	75 36	72 36	69 00	66 00	63 00	60 00	57 00	54 00	51 00	48 36	45 36	42 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.26	1.21	1.15	1.10	1.05	1.00	0.95	0.90	0.85	0.81	0.76	0.71	$\triangle_1 h$
Log.	0.100 37	0.082 79	0.060 70	0.041 39	0.021 19	0.00 . . .	9.977 72	9.954 24	9.929 42	9.908 49	9.880 81	9.851 26	Log.
Limit	61	62	64	66	68	70	72	74	76	78	80	82	Minutes
Meridian	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	Altitudes

Latitude 10° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 59	2 42	2 28	2 17	2 07	1 59	1 51	1 45	1 39	1 34	1 29	1 25	4
8	11 53	10 48	9 55	9 09	8 30	7 57	7 26	7 00	6 37	6 16	5 57	5 39	8
12	26 44	24 18	22 18	20 36	19 08	17 52	16 46	15 45	14 53	14 05	13 22	12 43	12
16	...	43 14	39 38	36 36	34 00	31 44	29 46	27 59	26 27	25 03	23 46	22 37	16
20	...	...	...	57 12	53 08	49 36	46 32	43 44	41 20	39 08	37 08	35 20	20
24	...	...	...	...	...	...	...	62 59	59 31	56 21	53 28	50 53	24
28	...	...	...	...	...	...	...	...	81 01	76 42	72 47	69 15	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	11.14	10.13	9.29	8.58	7.97	7.44	6.98	6.56	6.20	5.87	5.57	5.30	$\Delta_1 h$
Log.	1.046 89	1.005 61	0.968 02	0.933 49	0.901 46	0.871 57	0.843 86	0.816 90	0.792 39	0.768 64	0.745 86	0.734 28	Log.
Limit	13	14	15	16	17	18	19	20	21	22	23	24	Minutes
Meridian	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 21	1 17	1 14	1 10	1 08	1 05	1 02	1 00	0 58	0 56	0 54	0 52	4
8	5 23	5 08	4 55	4 43	4 32	4 21	4 10	4 02	3 52	3 45	3 36	3 30	8
12	12 07	11 34	11 03	10 37	10 11	9 46	9 25	9 03	8 42	8 25	8 07	7 51	12
16	21 33	20 34	19 41	18 51	18 05	17 22	16 43	16 05	15 30	14 59	14 25	13 57	16
20	33 40	32 08	30 44	29 28	28 16	27 08	26 08	25 08	24 12	23 24	22 32	21 48	20
24	48 29	46 17	44 16	42 26	40 42	39 04	37 38	36 11	34 51	33 42	32 27	31 23	24
28	65 59	62 59	60 14	57 46	55 24	53 11	51 14	49 16	47 26	45 52	44 10	42 44	28
32	...	82 15	78 40	75 26	72 22	69 28	65 54	64 21	61 57	59 54	57 41	55 49	32
36	...	...	...	...	...	...	...	...	78 25	75 49	73 01	70 38	36
40	...	...	...	...	...	...	...	...	...	...	90 08	87 12	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	5.05	4.82	4.61	4.42	4.24	4.07	3.92	3.77	3.63	3.51	3.38	3.27	$\Delta_1 h$
Log.	0.703 29	0.683 05	0.663 70	0.645 42	0.627 37	0.609 59	0.593 29	0.576 34	0.559 91	0.545 31	0.528 92	0.514 55	Log.
Limit	25	26	27	27	28	29	30	31	31	32	33	34	Minutes
Meridian	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	Altitudes

Latitude 10° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 51	0 49	0 47	0 46	0 44	0 43	0 42	0 40	0 39	0 38	0 37	0 36	4
8	3 22	3 16	3 09	3 03	2 58	2 52	2 47	2 42	2 37	2 32	2 28	2 24	8
12	7 35	7 21	7 07	6 52	6 39	6 27	6 15	6 04	5 53	5 43	5 32	5 23	12
16	13 29	13 03	12 37	12 12	11 49	11 29	11 09	10 48	10 27	10 09	9 52	9 33	16
20	21 04	20 24	19 44	19 04	18 28	17 56	17 24	16 52	16 20	15 52	15 24	14 56	20
24	30 21	29 23	28 25	27 28	26 35	25 50	25 04	24 17	23 31	22 51	22 11	21 30	24
28	41 17	39 59	38 41	37 22	36 12	35 09	34 06	33 04	32 01	31 06	30 11	29 16	28
32	53 55	52 13	50 31	48 48	47 17	45 54	44 32	43 11	41 49	40 37	39 25	38 14	32
36	68 16	66 06	63 56	61 47	59 50	58 07	56 23	54 39	52 55	51 25	49 54	48 23	36
40	84 16	81 36	78 56	76 16	73 52	71 44	69 36	67 28	65 20	63 28	61 36	59 44	40
44	...	...	...	...	...	86 48	84 13	81 38	79 03	76 48	74 32	72 16	44
48	...	...	...	...	...	...	...	...	94 05	91 23	88 42	86 01	48
52	...	...	...	...	...	...	...	...	...	107 15	104 06	100 57	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	3.16	3.06	2.96	2.86	2.77	2.69	2.61	2.53	2.45	2.38	2.31	2.24	△₁h
Log.	0.49969	0.48572	0.47129	0.45637	0.44248	0.42975	0.41664	0.40312	0.38917	0.37658	0.36361	0.35025	Log.
Limit	35	36	37	38	39	40	41	41	42	43	44	45	Minutes
Meridian	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 34	0 33	0 31	0 30	0 30	0 29	0 28	0 27	0 27	0 26	0 25	4
8	2 19	2 15	2 11	2 07	2 03	2 00	1 56	1 54	1 50	1 47	1 43	1 41	8
12	5 12	5 03	4 55	4 47	4 38	4 29	4 22	4 16	4 08	4 00	3 53	3 46	12
16	9 16	9 01	8 45	8 29	8 14	7 59	7 46	7 33	7 20	7 08	6 55	6 42	16
20	14 28	14 04	13 40	13 16	12 52	12 28	12 08	11 48	11 28	11 08	10 48	10 28	20
24	20 50	20 16	19 41	19 06	18 31	17 57	17 29	16 59	16 31	16 02	15 34	15 04	24
28	28 51	27 34	26 47	26 01	25 14	24 26	23 47	23 08	22 29	21 49	21 10	20 31	28
32	37 02	36 00	34 59	33 58	32 57	31 55	31 03	30 13	29 21	28 30	27 38	26 48	32
36	46 53	45 35	44 17	42 59	41 41	40 24	39 19	38 14	37 09	36 05	35 00	33 55	36
40	57 52	56 16	54 40	53 04	51 28	49 52	48 32	47 12	45 52	44 32	43 12	41 52	40
44	70 02	68 05	66 09	64 12	62 16	60 21	58 44	57 07	55 30	53 54	52 17	50 40	44
48	83 19	81 01	78 43	76 25	74 07	71 48	69 53	67 56	66 01	64 07	62 12	60 17	48
52	97 47	95 05	92 23	89 41	86 59	84 16	82 01	79 46	77 31	75 15	73 00	70 45	52
56	...	...	...	104 01	100 52	97 45	95 08	92 31	89 54	87 18	84 41	82 04	56
60	...	...	...	...	...	112 12	109 12	106 12	103 12	100 12	97 12	94 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.17	2.11	2.05	1.99	1.93	1.87	1.82	1.77	1.72	1.67	1.62	1.57	△₁h
Log.	0.33646	0.32428	0.31175	0.29885	0.28556	0.27184	0.26007	0.24797	0.23553	0.22272	0.20952	0.19590	Log.
Limit	46	47	48	49	49	50	51	52	53	54	55	56	Minutes
Meridian	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 24	0 23	0 22	0 22	0 22	0 21	0 20	0 19	0 19	0 19	0 18	0 17	4
8	1 38	1 35	1 33	1 29	1 26	1 23	1 21	1 18	1 15	1 13	1 11	1 08	8
12	3 40	3 34	3 28	3 20	3 14	3 08	3 02	2 56	2 50	2 44	2 39	2 34	12
16	6 32	6 18	6 08	5 56	5 46	5 36	5 22	5 12	5 02	4 52	4 45	4 34	16
20	10 12	9 52	9 36	9 16	9 00	8 44	8 24	8 08	7 52	7 36	7 24	7 08	20
24	14 41	14 12	13 49	13 21	12 58	12 35	12 06	11 43	11 20	10 57	10 40	10 16	24
28	20 00	19 21	18 49	18 10	17 38	17 07	16 28	15 57	15 25	14 53	14 30	13 59	28
32	26 07	25 16	24 35	23 43	23 02	22 21	21 30	20 49	20 08	19 27	18 56	18 16	32
36	33 03	31 58	31 06	30 02	29 10	28 18	27 13	26 21	25 30	24 38	23 59	23 07	36
40	40 48	39 28	38 24	37 04	36 00	34 56	33 36	32 32	31 28	30 24	29 36	28 32	40
44	49 22	47 45	46 27	44 51	43 34	42 16	40 39	39 22	38 05	36 47	35 49	34 32	44
48	58 45	56 50	55 18	53 22	51 50	50 18	48 23	46 51	45 18	43 46	42 37	41 05	48
52	68 57	66 42	64 54	62 38	60 50	59 02	56 47	54 29	53 10	51 22	50 01	48 13	52
56	79 58	77 21	75 15	72 39	70 34	68 28	65 51	63 46	61 41	59 35	58 01	55 56	56
60	91 48	88 48	86 24	83 24	81 00	78 36	75 36	73 12	70 48	68 24	66 36	64 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.53	1.48	1.44	1.39	1.35	1.31	1.26	1.22	1.18	1.14	1.11	1.07	$\triangle_1$h
Log.	0.184 69	0.170 26	0.158 36	0.143 01	0.130 33	0.117 27	0.100 37	0.086 36	0.071 88	0.056 90	0.045 32	0.029 38	Log.
Limit	57	58	60	61	62	64	66	68	69	70	72	74	Minutes
Meridian	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 16	0 15	0 15	0 14	0 14	0 14	0 13	0 12	0 12	0 11	0 11	0 11	4
8	1 06	1 03	1 01	0 58	0 56	0 54	0 51	0 50	0 47	0 45	0 42	0 40	8
12	2 28	2 23	2 17	2 13	2 07	2 01	1 56	1 51	1 47	1 41	1 36	1 32	12
16	4 24	4 13	4 03	3 55	3 45	3 35	3 28	3 17	3 09	2 59	2 52	2 44	16
20	6 52	6 36	6 20	6 08	5 52	5 36	5 24	5 08	4 56	4 40	4 28	4 16	20
24	9 53	9 30	9 07	8 50	8 27	8 04	7 47	7 23	7 06	6 43	6 26	6 09	24
28	13 28	12 57	12 25	12 02	11 30	10 58	10 35	10 04	9 40	9 09	8 45	8 21	28
32	17 35	16 54	16 13	15 42	15 01	14 20	13 49	13 09	12 38	11 57	11 26	10 55	32
36	22 15	21 23	20 31	19 52	19 01	18 09	17 30	16 38	15 59	15 07	14 29	13 50	36
40	27 28	26 24	25 20	24 32	23 28	22 24	21 36	20 32	19 44	18 40	17 52	17 04	40
44	33 14	31 56	30 39	29 41	28 24	27 06	26 08	24 51	23 52	22 35	21 38	20 39	44
48	39 33	38 01	36 29	35 20	33 47	32 15	31 06	29 32	28 23	26 51	25 43	24 34	48
52	46 25	44 37	42 49	41 28	39 39	37 51	36 30	34 42	33 21	31 33	30 11	28 50	52
56	53 50	51 44	49 39	48 05	46 00	43 54	42 20	40 15	38 40	36 35	35 02	33 27	56
60	61 48	59 24	57 00	55 12	52 48	50 24	48 36	46 12	44 24	42 00	40 12	38 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.03	0.99	0.95	0.92	0.88	0.84	0.81	0.77	0.74	0.70	0.67	0.64	$\triangle_1$h
Log.	0.012 84	9.995 64	9.977 72	9.963 79	9.944 48	9.924 28	9.908 49	9.886 49	9.869 23	9.845 10	9.826 07	9.806 18	Log.
Limit	75	76	77	78	79	80	82	84	86	88	90	92	Minutes
Meridian	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	Altitudes

Latitude 11° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 42	2 58	3 17	3 42	4 12	4 54	5 52	...	...	...	...	...	4
8	10 46	11 50	13 08	14 45	16 50	19 36	23 27	...	...	...	...	...	8
12	24 14	26 38	29 32	33 11	37 53	...	...	...	...	...	...	...	12
16	43 06	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	10.10	11.10	12.31	13.83	15.78	18.37	21.99	...	...	...	...	...	$\triangle_1$h
Log.	1.004 32	1.045 32	1.090 26	1.140 82	1.198 11	1.264 11	1.342 23	... ...	... ...	... ...	... ...	... ...	Log.
Limit	14	13	12	11	10	9	7	6	5	3	1	0	Minutes
Meridian	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	5 40	4 43	4 01	3 29	3 05	2 46	2 30	2 16	4
8	...	...	...	...	22 41	18 48	16 03	13 58	12 21	11 03	10 00	9 06	8
12	...	...	...	...	...	...	36 06	31 25	27 48	24 52	22 29	20 28	12
16	...	...	...	...	...	...	...	...	...	44 12	39 59	36 24	16
20	...	...	...	...	...	...	...	...	...	...	...	56 52	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	21.26	17.63	15.04	13.09	11.58	10.36	9.37	8.53	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	1.327 56	1.246 25	1.177 25	1.116 94	1.063 71	1.015 36	0.971 74	0.930 95	Log.
Limit	2	4	5	7	8	9	10	11	13	15	16	17	Minutes
Meridian	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	Altitudes

Latitude 11° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 05	1 55	1 47	1 39	1 33	1 27	1 22	1 17	1 13	1 09	1 05	1 02	4
8	8 21	7 42	7 08	6 39	6 12	5 50	5 28	5 09	4 52	4 36	4 22	4 08	8
12	18 47	17 20	16 03	14 57	13 58	13 07	12 18	11 35	10 57	10 22	9 49	9 19	12
16	33 25	30 48	28 33	26 35	24 50	23 17	21 54	20 37	19 27	18 26	17 27	16 33	16
20	52 12	48 08	44 36	41 32	38 48	36 24	34 12	32 12	30 24	28 48	27 16	25 52	20
24	...	...	64 14	59 48	55 53	52 25	49 15	46 22	43 47	41 29	39 16	37 15	24
28	...	...	...	81 25	76 03	71 21	67 02	63 07	59 35	56 27	53 27	50 42	28
32	...	...	...	...	...	...	...	82 26	77 49	73 43	69 48	66 13	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	7.83	7.22	6.69	6.23	5.82	5.46	5.13	4.83	4.56	4.32	4.09	3.88	$\triangle_1 h$
Log.	0.893 76	0.858 54	0.825 43	0.794 49	0.764 92	0.737 19	0.710 12	0.683 95	0.658 96	0.635 48	0.611 72	0.588 83	Log.
Limit	18	19	20	21	22	23	24	26	27	28	29	30	Minutes
Meridian	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 59	0 56	0 54	0 51	0 49	0 46	0 44	0 43	0 41	0 39	0 37	0 36	4
8	3 56	3 45	3 34	3 24	3 15	3 06	2 58	2 50	2 43	2 37	2 29	2 24	8
12	8 51	8 25	8 02	7 39	7 19	6 59	6 41	6 23	6 07	5 52	5 35	5 23	12
16	15 45	14 59	14 18	13 37	13 01	12 25	11 51	11 21	10 53	10 24	9 57	9 33	16
20	24 36	23 24	22 20	21 16	20 20	19 24	18 32	17 44	17 00	16 16	15 32	14 56	20
24	35 26	33 42	32 10	30 38	29 17	27 56	26 41	25 33	24 29	23 25	22 22	21 30	24
28	48 13	45 52	43 46	41 41	39 51	38 02	36 20	34 45	33 19	31 53	30 27	29 16	28
32	62 58	59 54	57 10	54 26	52 03	49 40	47 27	45 23	43 31	41 39	39 46	38 14	32
36	79 43	75 49	72 22	68 55	65 53	62 51	60 03	57 28	55 05	52 42	50 20	48 23	36
40	...	...	89 20	85 04	81 20	77 36	74 08	70 56	68 00	65 04	62 08	59 44	40
44	...	...	...	...	...	...	...	85 50	82 17	78 43	75 11	72 16	44
48	...	...	...	...	...	...	...	...	...	93 42	89 28	86 01	48
52	...	...	...	...	...	...	...	...	...	...	105 00	100 57	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.69	3.51	3.35	3.19	3.05	2.91	2.78	2.66	2.55	2.44	2.33	2.24	$\triangle_1 h$
Log.	0.567 03	0.545 31	0.525 04	0.503 79	0.484 30	0.463 89	0.444 04	0.424 88	0.406 54	0.387 39	0.367 36	0.350 25	Log.
Limit	31	32	33	34	35	37	38	39	40	40	41	42	Minutes
Meridian	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	Altitudes

Latitude 11° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 33	0 31	0 30	0 29	0 27	0 27	0 25	0 24	0 23	0 22	0 22	4
8	2 17	2 11	2 05	2 01	1 56	1 51	1 46	1 42	1 37	1 34	1 30	1 26	8
12	5 08	4 55	4 44	4 32	4 20	4 09	3 59	3 49	3 39	3 31	3 22	3 13	12
16	9 08	8 45	8 24	8 04	7 44	7 23	7 05	6 47	6 29	6 13	5 58	5 43	16
20	14 16	13 40	13 08	12 36	12 04	11 32	11 04	10 36	10 08	9 44	9 20	8 56	20
24	20 33	19 41	18 54	18 09	17 23	16 36	15 57	15 16	14 36	14 01	13 26	12 52	24
28	27 57	26 47	25 45	24 42	23 39	22 37	21 41	20 47	19 52	19 05	18 18	17 30	28
32	36 31	34 59	33 38	32 15	30 53	29 32	28 19	27 08	25 56	24 55	23 54	22 52	32
36	46 14	44 17	42 33	40 50	39 06	37 22	35 52	34 21	32 50	31 32	30 14	28 57	36
40	57 04	54 40	52 32	50 24	48 16	46 08	44 16	42 24	40 32	38 56	37 20	35 44	40
44	69 03	66 09	63 34	60 59	58 24	55 49	53 34	51 18	49 03	47 06	45 10	43 14	44
48	82 10	78 43	75 39	72 34	69 30	66 24	63 44	61 03	58 22	56 04	53 46	51 27	48
52	96 26	92 23	88 47	85 10	81 34	77 58	74 48	71 39	68 30	65 48	63 06	60 23	52
56	...	107 09	102 57	98 47	94 36	90 25	86 46	83 06	79 27	76 18	73 10	70 02	56
60	...	...	...	113 24	108 36	103 48	99 36	95 24	91 12	87 36	84 00	80 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.14	2.05	1.97	1.89	1.81	1.73	1.66	1.59	1.52	1.46	1.40	1.34	$\triangle_1$h
Log.	0.330 41	0.311 75	0.294 47	0.276 46	0.257 68	0.238 05	0.220 11	0.201 40	0.181 84	0.164 35	0.146 13	0.127 10	Log.
Limit	43	44	45	47	48	50	51	52	53	54	56	58	Minutes
Meridian	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 19	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 13	0 12	0 11	4
8	1 22	1 18	1 14	1 11	1 08	1 04	1 01	0 58	0 55	0 51	0 50	0 47	8
12	3 05	2 56	2 47	2 39	2 33	2 25	2 19	2 11	2 04	1 56	1 51	1 45	12
16	5 27	5 12	4 57	4 45	4 31	4 19	4 05	3 53	3 40	3 28	3 17	3 07	16
20	8 32	8 08	7 44	7 24	7 04	6 44	6 24	6 04	5 44	5 24	5 08	4 52	20
24	12 17	11 43	11 09	10 40	10 11	9 42	9 13	8 44	8 16	7 47	7 23	7 00	24
28	16 44	15 57	15 09	14 30	13 51	13 12	12 33	11 54	11 14	10 35	10 04	9 33	28
32	21 51	20 49	19 47	18 56	18 05	17 14	16 23	15 32	14 40	13 49	13 09	12 28	32
36	27 39	26 21	25 04	23 59	22 54	21 49	20 44	19 39	18 35	17 30	16 38	15 46	36
40	34 08	32 32	30 56	29 36	28 16	26 56	25 36	24 16	22 56	21 36	20 32	19 28	40
44	41 18	39 22	37 26	35 49	34 12	32 35	30 58	29 21	27 45	26 08	24 51	23 33	44
48	49 09	46 51	44 32	42 37	40 42	38 47	36 52	34 57	33 01	31 06	29 32	28 00	48
52	57 41	54 59	52 16	50 01	47 46	45 31	43 16	41 01	38 45	36 30	34 42	32 54	52
56	66 54	63 46	60 38	58 01	55 24	52 47	50 10	47 33	44 57	42 20	40 15	38 09	56
60	76 48	73 12	69 36	66 36	63 36	60 36	57 36	54 36	51 36	48 36	46 12	43 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.28	1.22	1.16	1.11	1.06	1.01	0.96	0.91	0.86	0.81	0.77	0.73	$\triangle_1$h
Log.	0.107 21	0.086 36	0.064 46	0.045 32	0.025 31	0.004 32	9.982 27	9.959 04	9.934 50	9.908 49	9.886 49	9.863 32	Log.
Limit	60	62	64	66	68	70	71	73	75	77	79	81	Minutes
Meridian	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	Altitudes

Latitude 11° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 42	2 28	2 17	2 07	1 58	1 51	1 45	1 39	1 34	1 29	1 25	1 21	4
8	10 46	9 54	9 08	8 29	7 56	7 26	7 00	6 36	6 15	5 57	5 39	5 23	8
12	24 14	22 15	20 33	19 07	17 50	16 44	15 45	14 51	14 04	13 22	12 43	12 07	12
16	43 06	39 33	36 31	33 57	31 42	29 44	27 59	26 25	25 00	23 46	22 37	21 33	16
20	...	...	57 04	53 04	49 32	46 28	43 44	41 16	39 04	37 08	35 20	33 40	20
24	...	...	...	...	...	...	62 59	59 26	56 16	53 28	50 53	48 29	24
28	...	...	...	...	...	...	...	80 53	76 34	72 47	69 15	65 59	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	10.10	9.27	8.56	7.96	7.43	6.97	6.56	6.19	5.86	5.57	5.30	5.05	$\Delta_1 h$
Log.	1.004 32	0.967 08	0.932 47	0.900 91	0.870 99	0.843 23	0.816 90	0.791 69	0.767 90	0.745 86	0.724 28	0.703 29	Log.
Limit	14	15	16	17	18	19	20	21	22	23	24	25	Minutes
Meridian	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 17	1 14	1 10	1 08	1 05	1 02	1 00	0 59	0 56	0 54	0 52	0 51	4
8	5 09	4 55	4 44	4 32	4 21	4 11	4 02	3 53	3 45	3 38	3 30	3 23	8
12	11 35	11 05	10 38	10 12	9 48	9 26	9 05	8 44	8 27	8 10	7 53	7 36	12
16	20 37	19 43	18 54	18 08	17 24	16 46	16 07	15 32	15 01	14 30	13 59	13 32	16
20	32 12	30 48	29 32	28 20	27 12	26 12	25 12	24 16	23 28	22 40	21 52	21 08	20
24	46 22	44 22	42 31	40 48	39 10	37 43	36 17	34 57	33 48	32 38	31 29	30 26	24
28	63 07	60 22	57 54	55 32	53 19	51 22	49 24	47 33	46 00	44 26	42 52	41 25	28
32	82 26	78 50	75 37	72 32	69 38	67 05	64 31	62 07	60 04	58 02	55 59	54 06	32
36	...	...	...	...	...	...	...	78 38	76 02	73 26	70 51	68 29	36
40	...	...	...	...	...	...	...	...	...	90 40	87 28	84 32	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	4.83	4.62	4.43	4.25	4.08	3.93	3.78	3.64	3.52	3.40	3.28	3.17	$\Delta_1 h$
Log.	0.683 95	0.664 64	0.646 40	0.628 39	0.610 66	0.594 39	0.577 49	0.561 10	0.546 54	0.531 48	0.515 87	0.501 06	Log.
Limit	26	27	28	28	29	30	31	32	32	33	34	35	Minutes
Meridian	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	Altitudes

Latitude 11° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 49	0 47	0 46	0 44	0 43	0 42	0 41	0 39	0 38	0 37	0 36	0 35	4
8	3 17	3 10	3 04	2 59	2 53	2 47	2 43	2 39	2 34	2 29	2 25	2 20	8
12	7 22	7 08	6 55	6 42	6 29	6 17	6 06	5 56	5 46	5 35	5 26	5 15	12
16	13 06	12 40	12 17	11 54	11 31	11 11	10 50	10 32	10 14	9 57	9 38	9 21	16
20	20 28	19 48	19 12	18 36	18 00	17 28	16 56	16 28	16 00	15 32	15 04	14 36	20
24	29 28	28 30	27 39	26 47	25 55	25 10	24 23	23 42	23 02	22 22	21 42	21 02	24
28	40 07	38 49	37 38	36 28	35 17	34 14	33 11	32 17	31 22	30 27	29 32	28 37	28
32	52 24	50 42	49 09	47 37	46 05	44 42	43 21	42 10	40 58	39 46	38 34	37 22	32
36	66 19	64 09	62 13	60 16	58 19	56 36	54 52	53 21	51 50	50 20	48 49	47 19	36
40	81 52	79 12	76 48	74 24	72 00	69 52	67 44	65 52	64 00	62 08	60 16	58 24	40
44	...	...	...	...	87 07	84 33	81 57	79 42	77 26	75 11	72 55	70 40	44
48	...	...	...	...	...	...	...	94 51	92 10	89 28	86 47	84 05	48
52	...	...	...	...	...	...	...	...	108 10	105 00	101 51	98 41	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	3.07	2.97	2.88	2.79	2.70	2.62	2.54	2.47	2.40	2.33	2.26	2.19	$\Delta_1 h$
Log.	0.487 14	0.472 76	0.459 39	0.445 60	0.431 36	0.418 30	0.404 83	0.392 70	0.380 21	0.367 36	0.354 11	0.340 44	Log.
Limit	36	37	38	39	40	41	42	42	43	44	45	46	Minutes
Meridian	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 34	0 33	0 32	0 31	0 30	0 30	0 28	0 28	0 27	0 27	0 26	0 25	4
8	2 16	2 13	2 09	2 05	2 01	1 58	1 55	1 52	1 48	1 45	1 42	1 39	8
12	5 06	4 58	4 49	4 43	4 34	4 25	4 18	4 11	4 03	3 56	3 50	3 43	12
16	9 06	8 50	8 35	8 21	8 06	7 51	7 38	7 25	7 13	7 00	6 50	6 37	16
20	14 12	13 48	13 24	13 04	12 40	12 16	11 56	11 36	11 16	10 56	10 40	10 20	20
24	20 27	19 52	19 18	18 49	18 14	17 40	17 11	16 42	16 14	15 45	15 22	14 53	24
28	27 50	27 03	26 16	25 37	24 50	24 02	23 24	22 44	22 05	21 25	20 54	20 15	28
32	36 21	35 20	34 18	33 27	32 26	31 24	30 33	29 42	28 50	27 59	27 18	26 27	32
36	46 01	44 43	43 25	42 20	41 02	39 45	38 40	37 35	36 31	35 26	34 34	33 29	36
40	56 48	55 12	53 36	52 16	50 40	49 04	47 44	46 24	45 04	43 44	42 40	41 20	40
44	68 44	66 48	64 51	63 14	61 18	59 22	57 45	56 08	54 32	52 55	51 38	50 01	44
48	81 46	79 29	77 11	75 16	72 58	70 39	68 42	66 47	64 53	62 58	61 26	59 31	48
52	95 59	93 17	90 35	88 20	85 38	82 55	80 40	78 25	76 09	73 54	72 06	69 51	52
56	...	108 12	105 03	102 26	99 18	96 10	93 33	90 56	88 20	85 43	83 38	81 01	56
60	...	...	...	...	114 00	110 24	107 24	104 24	101 24	98 24	96 00	93 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.13	2.07	2.01	1.96	1.90	1.84	1.79	1.74	1.69	1.64	1.60	1.55	$\Delta_1 h$
Log.	0.328 38	0.315 97	0.303 20	0.292 26	0.278 75	0.264 82	0.252 85	0.240 55	0.227 89	0.214 84	0.204 12	0 190 33	Log.
Limit	46	47	48	49	49	50	51	52	53	54	55	56	Minutes
Meridian	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	Altitudes

Latitude 11° Declination Contrary Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 24	0 23	0 22	0 22	0 21	0 20	0 20	0 19	0 19	0 18	0 17	0 17	4
8	1 36	1 34	1 31	1 28	1 25	1 23	1 20	1 17	1 15	1 12	1 10	1 08	8
12	3 36	3 31	3 25	3 17	3 11	3 06	3 00	2 54	2 48	2 42	2 37	2 33	12
16	6 24	6 13	6 03	5 51	5 41	5 30	5 20	5 10	5 00	4 50	4 39	4 31	16
20	10 00	9 44	9 28	9 08	8 52	8 36	8 20	8 04	7 48	7 32	7 16	7 04	20
24	14 24	14 01	13 38	13 09	12 46	12 23	12 00	11 37	11 14	10 51	10 28	10 11	24
28	19 36	19 05	18 34	17 54	17 23	16 52	16 20	15 49	15 17	14 46	14 15	13 51	28
32	25 36	24 55	24 14	23 23	22 42	22 01	21 20	20 39	19 58	19 17	18 36	18 05	32
36	32 24	31 32	30 40	29 36	28 44	27 52	27 00	26 08	25 17	24 25	23 33	22 54	36
40	40 00	38 56	37 52	36 32	35 28	34 24	33 20	32 16	31 12	30 08	29 04	28 16	40
44	48 24	47 06	45 49	44 13	42 55	41 37	40 20	39 02	37 46	36 28	35 10	34 12	44
48	57 36	56 04	54 32	52 36	51 04	49 32	48 00	46 28	44 55	43 23	41 51	40 42	48
52	67 36	65 48	64 00	61 44	59 56	58 08	56 20	54 32	52 43	55 55	49 07	47 46	52
56	78 24	76 18	74 13	71 37	69 31	67 25	65 20	63 14	61 10	59 04	56 58	55 24	56
60	90 00	87 36	85 12	82 12	79 48	77 24	75 00	72 36	70 12	67 48	65 24	63 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.50	1.46	1.42	1.37	1.33	1.29	1.25	1.21	1.17	1.13	1.09	1.06	$\triangle_1 h$
Log.	0.176 09	0.164 35	0.152 29	0.136 72	0.123 85	0.110 59	0.096 91	0.082 79	0.068 19	0.053 08	0.037 43	0.025 31	Log.
Limit	57	59	61	62	64	65	67	69	70	71	72	74	Minutes
Meridian	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 16	0 15	0 15	0 14	0 14	0 14	0 13	0 12	0 11	0 11	0 11	0 11	4
8	1 05	1 02	1 01	0 58	0 55	0 54	0 51	0 50	0 47	0 45	0 42	0 40	8
12	2 27	2 22	2 17	2 11	2 05	2 01	1 55	1 51	1 45	1 41	1 36	1 32	12
16	4 21	4 10	4 03	3 53	3 43	3 35	3 25	3 17	3 07	2 59	2 52	2 44	16
20	6 48	6 32	6 20	6 04	5 48	5 36	5 20	5 08	4 52	4 40	4 28	4 16	20
24	9 48	9 24	9 07	8 44	8 21	8 04	7 41	7 23	7 00	6 43	6 26	6 09	24
28	13 20	12 49	12 25	11 54	11 22	10 58	10 27	10 04	9 33	9 09	8 45	8 21	28
32	17 24	16 44	16 13	15 32	14 51	14 20	13 39	13 09	12 28	11 57	11 26	10 55	32
36	22 02	21 10	20 31	19 39	18 48	18 09	17 17	16 38	15 46	15 07	14 29	13 50	36
40	27 12	26 08	25 20	24 16	23 12	22 24	21 20	20 32	19 28	18 40	17 52	17 04	40
44	32 55	31 37	30 39	29 21	28 05	27 06	25 49	24 51	23 33	22 35	21 38	20 39	44
48	39 10	37 38	36 29	34 57	33 24	32 15	30 43	29 32	28 00	26 51	25 43	24 34	48
52	45 58	44 10	42 49	41 01	39 12	37 51	36 03	34 42	32 54	31 33	30 11	28 50	52
56	53 19	51 13	49 39	47 33	45 29	43 54	41 49	40 15	38 09	36 35	35 02	33 27	56
60	61 12	58 48	57 00	54 36	52 12	50 24	48 00	46 12	43 48	42 00	40 12	38 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.02	0.98	0.95	0.91	0.87	0.84	0.80	0.77	0.73	0.70	0.67	0.64	$\triangle_1 h$
Log.	0.008 60	9.991 23	9.977 72	9.959 04	9.939 52	9.924 28	9.903 09	9.886 49	9.863 32	9.845 10	9.826 07	9.806 18	Log.
Limit	76	77	78	79	79	80	82	84	86	88	90	92	Minutes
Meridian	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	Altitudes

Latitude 12° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 28	2 41	2 57	3 16	3 40	4 11	4 52	5 50	...	...	...	...	4
8	9 52	10 44	11 47	13 05	14 22	16 45	19 30	23 20	...	...	...	...	8
12	22 11	24 09	26 31	29 26	33 03	37 41	...	...	...	...	...	...	12
16	39 25	42 55	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	9.24	10.06	11.05	12.26	13.77	15.70	18.27	21.87	...	...	...	...	$\triangle_1 h$
Log.	0.965 67	1.002 60	1.043 36	1.088 49	1.138 93	1.195 90	1.261 74	1.339 85	... ...	... ...	... ...	... ...	Log.
Limit	15	14	13	12	11	10	8	7	6	5	3	1	Minutes
Meridian	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	5 37	4 39	3 58	3 27	3 03	2 44	2 28	4
8	...	...	...	...	...	22 29	18 39	15 53	13 50	12 14	10 56	9 54	8
12	...	...	...	...	...	...	...	35 46	31 08	27 31	24 36	22 15	12
16	...	...	...	...	...	...	...	...	...	...	43 44	39 33	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	21.07	17.47	14.90	12.97	11.46	10.25	9.27	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	1.323 66	1.242 29	1.173 19	1.112 94	1.059 18	1.010 72	0.967 08	Log.
Limit	0	2	4	5	7	8	9	10	12	14	15	16	Minutes
Meridian	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 15	2 04	1 55	1 46	1 39	1 32	1 26	1 21	1 16	1 11	1 08	1 04	4
8	9 01	8 16	7 37	7 03	6 33	6 08	5 44	5 24	5 05	4 48	4 32	4 18	8
12	20 16	18 35	17 08	15 51	14 45	13 48	12 55	12 09	11 26	10 47	10 12	9 40	12
16	36 00	33 01	30 28	28 13	26 15	24 32	22 57	21 35	20 18	19 09	18 08	17 12	16
20	56 16	51 36	47 36	44 04	41 00	38 20	35 52	33 44	31 44	29 56	28 20	26 52	20
24	...	...	...	63 28	59 03	55 12	51 39	48 35	45 42	43 05	40 48	38 41	24
28	...	...	...	...	80 21	75 08	70 18	66 07	62 10	58 41	55 32	52 40	28
32	...	...	...	...	...	...	...	...	81 14	76 38	72 32	68 47	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	8.44	7.74	7.14	6.61	6.15	5.75	5.38	5.06	4.76	4.49	4.25	4.03	Δ_1h
Log.	0.926 34	0.888 74	0.853 70	0.820 20	0.788 88	0.759 67	0.730 78	0.704 15	0.677 61	0.652 25	0.628 39	0.605 31	Log.
Limit	17	18	19	20	21	22	23	25	26	27	28	29	Minutes
Meridian	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 01	0 58	0 55	0 52	0 50	0 47	0 46	0 43	0 42	0 39	0 38	0 36	4
8	4 05	3 52	3 41	3 31	3 20	3 11	3 02	2 55	2 47	2 40	2 33	2 26	8
12	9 10	8 42	8 17	7 54	7 30	7 11	6 50	6 33	6 15	5 59	5 44	5 29	12
16	16 18	15 30	14 43	14 02	13 22	12 45	12 10	11 39	11 09	10 37	10 12	9 43	16
20	25 28	24 12	23 00	21 56	20 52	19 56	19 00	18 12	17 24	16 36	15 56	15 12	20
24	36 41	34 51	33 07	31 35	30 03	28 42	27 22	26 12	25 04	23 54	22 57	21 53	24
28	49 55	47 26	45 05	43 00	40 54	39 05	37 14	35 41	34 06	32 33	31 14	29 48	28
32	65 11	61 57	58 53	56 09	53 25	51 02	48 38	46 36	44 32	42 30	40 47	38 55	32
36	...	78 25	74 31	71 04	67 37	64 35	61 34	58 58	56 23	53 47	51 38	49 15	36
40	...	...	92 00	87 44	83 28	79 44	76 00	72 48	69 36	66 24	63 44	60 48	40
44	...	...	...	...	...	...	...	88 05	84 13	80 20	77 07	73 34	44
48	...	...	...	...	...	...	...	...	...	95 37	91 46	87 33	48
52	...	...	...	...	...	...	...	...	...	...	107 42	102 45	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	3.82	3.63	3.45	3.29	3.13	2.99	2.85	2.73	2.61	2.49	2.39	2.28	Δ_1h
Log.	0.582 06	0.559 91	0.537 82	0.517 20	0.495 54	0.475 67	0.454 84	0.436 16	0.416 64	0.396 20	0.378 40	0.357 93	Log.
Limit	30	31	32	33	34	35	36	37	38	40	41	42	Minutes
Meridian	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	Altitudes

Latitude 12° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 33	0 32	0 30	0 30	0 28	0 27	0 26	0 25	0 23	0 22	0 22	4
8	2 20	2 14	2 09	2 02	1 58	1 53	1 48	1 43	1 39	1 35	1 30	1 26	8
12	5 15	5 01	4 49	4 37	4 25	4 14	4 03	3 53	3 43	3 34	3 23	3 14	12
16	9 21	8 55	8 35	8 11	7 51	7 30	7 13	6 55	6 37	6 18	6 01	5 46	16
20	14 36	13 56	13 24	12 48	12 16	11 44	11 16	10 48	10 20	9 52	9 24	9 00	20
24	21 02	20 04	19 18	18 26	17 40	16 54	16 14	15 34	14 53	14 12	13 32	12 58	24
28	28 37	27 19	26 16	25 06	24 02	23 00	22 05	21 10	20 15	19 21	18 26	17 38	28
32	37 22	35 40	34 18	32 46	31 24	30 02	28 50	27 38	26 27	25 16	24 04	23 02	32
36	47 19	45 09	43 25	41 28	39 45	38 01	36 51	35 00	33 29	31 58	30 27	29 10	36
40	58 24	55 44	53 36	51 12	49 04	46 56	45 04	43 12	41 20	39 28	37 36	36 00	40
44	70 40	67 26	64 51	61 57	59 22	56 47	54 32	52 17	50 01	47 45	45 29	43 34	44
48	84 05	80 15	77 11	73 44	70 39	67 33	64 53	62 12	59 31	56 50	54 09	51 50	48
52	98 41	94 11	90 35	86 32	82 55	79 19	76 09	73 00	69 51	66 42	63 33	60 50	52
56	. . .	. . .	105 03	100 21	96 10	91 59	88 20	84 41	81 01	77 21	73 41	70 34	56
60	. . .	. . .	. . .	. . .	110 24	105 36	101 24	97 12	93 00	88 48	84 36	81 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.19	2.09	2.01	1.92	1.84	1.76	1.69	1.62	1.55	1.48	1.41	1.35	$\Delta_1 h$
Log.	0.340 44	0.320 15	0.303 20	0.283 30	0.264 82	0.245 51	0.227 89	0.209 52	0.190 33	0.170 26	0.149 22	0.130 33	Log.
Limit	43	44	45	46	47	49	50	51	52	53	55	57	Minutes
Meridian	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 19	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 13	0 12	0 11	4
8	1 23	1 19	1 15	1 11	1 08	1 04	1 01	0 58	0 55	0 52	0 50	0 46	8
12	3 06	2 57	2 50	2 41	2 34	2 25	2 19	2 11	2 05	1 58	1 51	1 44	12
16	5 30	5 15	5 02	4 47	4 34	4 19	4 05	3 53	3 43	3 30	3 17	3 04	16
20	8 36	8 12	7 52	7 28	7 08	6 44	6 24	6 04	5 48	5 28	5 08	4 48	20
24	12 23	11 48	11 20	10 46	10 16	9 42	9 13	8 44	8 21	7 53	7 23	6 55	24
28	16 52	16 05	15 25	14 38	13 59	13 12	12 33	11 54	11 22	10 43	10 04	9 25	28
32	22 01	21 00	20 08	19 06	18 16	17 14	16 23	15 32	14 51	13 59	13 09	12 17	32
36	27 52	26 34	25 30	24 12	23 07	21 49	20 44	19 39	18 48	17 43	16 38	15 33	36
40	34 24	32 48	31 28	29 52	28 32	26 56	25 36	24 16	23 12	21 52	20 32	19 12	40
44	41 37	39 41	38 05	36 09	34 32	32 35	30 58	29 21	28 05	26 28	24 51	23 14	44
48	49 32	47 14	45 18	43 00	41 05	38 47	36 52	34 57	33 24	31 29	29 32	27 37	48
52	58 08	55 26	53 10	50 28	48 13	45 31	43 16	41 01	39 12	36 57	34 42	32 27	52
56	67 25	64 17	61 41	58 33	55 56	52 47	50 10	47 33	45 29	42 52	40 15	37 38	56
60	77 24	73 48	70 48	67 12	64 12	60 36	57 36	54 36	52 12	49 12	46 12	43 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.29	1.23	1.18	1.12	1.07	1.01	0.96	0.91	0.87	0.82	0.77	0.72	$\Delta_1 h$
Log.	0.110 59	0.089 91	0.071 88	0.049 22	0.029 38	0.004 32	9.982 27	9.959 04	9.939 52	9.913 81	9.886 49	9.857 33	Log.
Limit	59	61	63	65	67	69	71	73	75	77	79	81	Minutes
Meridian	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 28	2 17	2 06	1 58	1 51	1 45	1 39	1 34	1 29	1 24	1 21	1 17	4
8	9 52	9 07	8 27	7 55	7 24	6 59	6 35	6 15	5 56	5 39	5 23	5 09	8
12	22 11	20 30	19 02	17 47	16 41	15 42	14 50	14 04	13 21	12 42	12 07	11 35	12
16	39 25	36 26	33 50	31 37	29 39	27 54	26 22	25 00	23 43	22 34	21 33	20 37	16
20	...	56 56	52 52	49 24	46 20	43 36	41 12	39 04	37 04	35 16	33 40	32 12	20
24	...	...	...	...	66 43	62 47	59 20	56 16	53 23	50 47	48 29	46 22	24
28	...	...	...	...	...	...	80 45	76 34	72 39	69 08	65 59	63 07	28
32	...	...	...	...	...	...	...	...	...	...	...	82 26	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	9.24	8.54	7.93	7.41	6.95	6.54	6.18	5.86	5.56	5.29	5.05	4.83	$\triangle_1$h
Log.	0.965 67	0.931 46	0.899 27	0.869 82	0.841 98	0.815 58	0.790 99	0.767 90	0.745 07	0.723 46	0.703 29	0.683 95	Log.
Limit	15	16	17	18	19	20	20	21	22	23	24	25	Minutes
Meridian	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 14	1 10	1 08	1 05	1 02	1 00	0 59	0 56	0 54	0 52	0 51	0 49	4
8	4 55	4 44	4 32	4 22	4 11	4 03	3 53	3 46	3 39	3 31	3 23	3 17	8
12	11 05	10 38	10 12	9 49	9 26	9 06	8 45	8 28	8 11	7 54	7 38	7 24	12
16	19 43	18 54	18 08	17 27	16 46	16 10	15 35	15 04	14 33	14 02	13 34	13 08	16
20	30 48	29 32	28 20	27 16	26 12	25 16	24 20	23 32	22 44	21 56	21 12	20 32	20
24	44 22	42 31	40 48	39 16	37 43	36 23	35 03	33 53	32 44	31 35	30 32	29 34	24
28	60 22	57 54	55 32	53 27	51 22	49 32	47 41	46 08	44 34	43 00	41 33	40 15	28
32	78 50	75 37	72 32	69 48	67 05	64 41	62 17	60 15	58 12	56 09	54 16	52 34	32
36	...	...	...	...	...	...	78 51	76 15	73 39	71 04	68 42	66 32	36
40	...	...	...	...	...	...	...	...	90 56	87 44	84 48	82 08	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	4.62	4.43	4.25	4.09	3.93	3.79	3.65	3.53	3.41	3.29	3.18	3.08	$\triangle_1$h
Log.	0.664 64	0.646 40	0.628 39	0.611 72	0.594 39	0.578 64	0.562 29	0.547 77	0.532 75	0.517 20	0.502 43	0.488 55	Log.
Limit	26	27	28	29	30	31	32	33	33	34	35	36	Minutes
Meridian	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	Altitudes

Latitude 12° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 47	0 46	0 45	0 43	0 43	0 41	0 39	0 38	0 38	0 36	0 35	0 35	4
8	3 11	3 05	2 59	2 54	2 49	2 44	2 40	2 35	2 30	2 26	2 22	2 17	8
12	7 11	6 56	6 43	6 32	6 20	6 09	5 59	5 47	5 37	5 29	5 18	5 09	12
16	12 45	12 20	11 57	11 36	11 16	10 55	10 37	10 17	9 59	9 43	9 26	9 11	16
20	19 56	19 16	18 40	18 08	17 36	17 04	16 36	16 04	15 36	15 12	14 44	14 20	20
24	28 42	27 45	26 53	26 07	25 21	24 35	23 54	23 08	22 28	21 53	21 13	20 39	24
28	39 05	37 46	36 35	35 33	34 29	33 27	32 33	31 30	30 34	29 48	28 53	28 05	28
32	51 02	49 19	47 47	46 25	45 03	43 41	42 30	41 08	39 56	38 55	37 43	36 41	32
36	64 35	62 26	60 29	58 45	57 02	55 18	53 47	52 03	50 33	49 15	47 44	46 27	36
40	79 44	77 04	74 40	72 32	70 24	68 16	66 24	64 16	62 24	60 48	58 56	57 20	40
44	...	...	...	87 46	85 11	82 36	80 20	77 45	75 30	73 34	71 18	69 23	44
48	...	...	...	...	...	...	95 37	92 33	89 51	87 33	84 52	82 33	48
52	...	...	...	...	...	...	...	...	105 27	102 45	99 36	96 53	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.99	2.89	2.80	2.72	2.64	2.56	2.49	2.41	2.34	2.28	2.21	2.15	$\triangle_1 h$
Log.	0.475 67	0.460 90	0.447 16	0.434 57	0.421 60	0.408 24	0.396 20	0.382 02	0.369 22	0.357 93	0.344 39	0.332 44	Log.
Limit	37	38	38	39	40	41	42	43	44	45	46	46	Minutes
Meridian	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 33	0 32	0 31	0 30	0 30	0 29	0 28	0 27	0 27	0 26	0 25	0 24	4
8	2 14	2 10	2 06	2 02	2 00	1 56	1 53	1 50	1 47	1 43	1 41	1 38	8
12	5 01	4 52	4 46	4 37	4 29	4 20	4 14	4 06	4 00	3 53	3 46	3 40	12
16	8 55	8 40	8 26	8 11	7 59	7 44	7 30	7 18	7 08	6 55	6 42	6 32	16
20	13 56	13 32	13 12	12 48	12 28	12 04	11 44	11 24	11 08	10 48	10 28	10 12	20
24	20 04	19 29	19 00	18 26	17 57	17 23	16 54	16 25	16 02	15 34	15 04	14 41	24
28	27 19	26 32	25 53	25 06	24 26	23 39	23 00	22 21	21 49	21 10	20 31	20 00	28
32	35 40	34 39	33 48	32 46	31 55	30 53	30 02	29 11	28 30	27 38	26 48	26 07	32
36	45 09	43 51	42 46	41 28	40 24	39 06	38 01	36 56	36 05	35 00	33 55	33 03	36
40	55 44	54 08	52 48	51 12	49 52	48 16	46 56	45 36	44 32	43 12	41 52	40 48	40
44	67 26	65 30	63 53	61 57	60 21	58 24	56 47	55 10	53 54	52 17	50 40	49 22	44
48	80 15	77 57	76 02	73 44	71 48	69 30	67 33	65 38	64 07	62 12	60 17	58 45	48
52	94 11	91 29	89 14	86 32	84 16	81 34	79 19	77 04	75 15	73 00	70 45	68 57	52
56	...	...	103 29	100 21	97 45	94 36	91 59	89 22	87 18	84 41	82 04	79 58	56
60	...	...	...	...	112 12	108 36	105 36	102 36	100 12	97 12	94 12	91 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.09	2.03	1.98	1.92	1.87	1.81	1.76	1.71	1.67	1.62	1.57	1.53	$\triangle_1 h$
Log.	0.320 15	0.307 50	0.296 67	0.283 30	0.271 84	0.257 68	0.245 51	0.233 00	0.222 72	0.209 52	0.195 90	0.184 69	Log.
Limit	47	48	49	50	50	51	52	53	54	55	56	57	Minutes
Meridian	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	Altitudes

Latitude 12° Declination Contrary Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 22	0 22	0 22	0 21	0 20	0 20	0 19	0 19	0 18	0 17	0 17	4
8	1 35	1 33	1 30	1 27	1 24	1 22	1 20	1 17	1 14	1 11	1 09	1 07	8
12	3 34	3 28	3 22	3 16	3 10	3 05	2 59	2 53	2 47	2 41	2 36	2 31	12
16	6 18	6 08	5 58	5 48	5 38	5 27	5 17	5 07	4 57	4 47	4 36	4 29	16
20	9 52	9 36	9 20	9 04	8 48	8 32	8 16	8 00	7 44	7 28	7 12	7 00	20
24	14 12	13 49	13 36	13 04	12 41	12 17	11 54	11 31	11 09	10 46	10 22	10 05	24
28	19 21	18 49	18 18	17 46	17 15	16 44	16 12	15 41	15 09	14 38	14 07	13 43	28
32	25 16	24 35	23 54	23 12	22 31	21 51	21 10	20 29	19 47	19 06	18 26	17 55	32
36	31 58	31 06	30 14	29 23	28 31	27 39	26 47	25 55	25 04	24 12	23 20	22 41	36
40	39 28	38 24	37 20	36 16	35 12	34 08	33 04	32 00	30 56	29 52	28 48	28 00	40
44	47 45	46 27	45 10	43 53	42 36	41 18	40 00	38 43	37 26	36 09	34 51	33 53	44
48	56 50	55 18	53 46	52 13	50 41	49 09	47 37	46 05	44 32	43 00	41 28	40 19	48
52	66 42	64 54	63 06	61 17	59 29	57 41	55 53	54 05	52 16	50 28	48 40	47 19	52
56	77 21	75 15	73 10	71 05	69 00	66 54	64 48	62 43	60 38	58 33	56 27	54 53	56
60	88 48	86 24	84 00	81 36	79 12	76 48	74 24	72 00	69 36	67 12	64 48	63 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.48	1.44	1.40	1.36	1.32	1.28	1.24	1.20	1.16	1.12	1.08	1.05	$\Delta_1 h$
Log.	0.170 26	0.158 36	0.146 13	0.133 54	0.120 57	0.107 21	0.093 42	0.079 18	0.064 46	0.049 22	0.033 42	0.021 19	Log.
Limit	58	60	61	62	64	65	67	69	70	71	72	74	Minutes
Meridian	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 16	0 15	0 15	0 14	0 14	0 13	0 13	0 12	0 11	0 11	0 11	0 10	4
8	1 04	1 02	1 00	0 57	0 55	0 53	0 51	0 49	0 47	0 44	0 42	0 40	8
12	2 25	2 20	2 16	2 10	2 05	1 59	1 55	1 50	1 45	1 39	1 35	1 30	12
16	4 19	4 08	4 00	3 50	3 43	3 33	3 25	3 14	3 07	2 57	2 49	2 42	16
20	6 44	6 28	6 16	6 00	5 48	5 32	5 20	5 04	4 52	4 36	4 24	4 12	20
24	9 42	9 18	9 01	8 38	8 21	7 58	7 41	7 18	7 00	6 38	6 21	6 03	24
28	13 12	12 41	12 17	11 46	11 22	10 51	10 27	9 56	9 33	9 01	8 37	8 14	28
32	17 14	16 34	16 03	15 22	14 51	14 10	13 39	12 58	12 28	11 46	11 15	10 45	32
36	21 49	20 57	20 18	19 26	18 48	17 56	17 17	16 25	15 46	14 55	14 16	13 37	36
40	26 56	25 52	25 04	24 00	23 12	22 08	21 20	20 16	19 28	18 24	17 36	16 48	40
44	32 35	31 18	30 19	29 02	28 05	26 47	25 49	24 31	23 33	22 16	21 18	20 20	44
48	38 47	37 15	36 06	34 34	33 24	31 52	30 43	29 09	28 00	26 29	25 20	24 11	48
52	45 31	43 43	42 22	40 34	39 12	37 24	36 03	34 15	32 54	31 05	29 44	28 23	52
56	52 47	50 42	49 07	47 02	45 29	43 23	41 49	39 43	38 09	36 04	34 30	32 56	56
60	60 36	58 12	56 24	54 00	52 12	49 48	48 00	45 36	43 48	41 24	39 36	37 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.01	0.97	0.94	0.90	0.87	0.83	0.80	0.76	0.73	0.69	0.66	0.63	$\Delta_1 h$
Log.	0.004 32	9.986 77	9.973 13	9.954 24	9.939 52	9.919 08	9.903 09	9.880 81	9.863 32	9.838 85	9.819 54	9.799 34	Log.
Limit	76	77	78	79	80	81	82	84	86	88	90	92	Minutes
Meridian	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	Altitudes

Latitude 13° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 16	2 27	2 40	2 56	3 15	3 39	4 10	4 51	5 48	...	...	...	4
8	9 04	9 49	10 41	11 44	13 01	14 36	16 39	19 23	23 12	...	...	...	8
12	20 24	22 05	24 03	26 24	29 17	32 51	37 27	...	...	...	...	...	12
16	36 16	39 15	42 45	...	...	...	...	...	...	...	...	...	16
20	56 40	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	8.50	9.20	10.02	11.00	12.20	13.69	15.61	18.17	21.74	...	...	...	$\Delta_1 h$
Log.	0.929 42	0.963 79	1.000 87	1.041 39	1.086 36	1.136 40	1.193 40	1.259 35	1.337 26	... ...	... ...	... ...	Log.
Limit	16	15	14	13	12	11	10	8	7	6	4	3	Minutes
Meridian	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	5 34	4 37	3 56	3 26	3 02	2 42	4
8	...	...	...	...	...	...	22 16	18 28	15 44	13 41	12 06	10 49	8
12	...	...	...	...	...	...	...	...	35 24	30 47	27 13	24 20	12
16	...	...	...	...	...	...	...	...	...	...	...	43 16	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	...	...	...	20.88	17.31	14.75	12.83	11.34	10.14	$\Delta_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	1.319 73	1.238 30	1.168 79	1.108 23	1.054 61	1.006 04	Log.
Limit	1	0	1	3	5	7	9	10	11	12	13	14	Minutes
Meridian	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	Altitudes

Latitude 13° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 27	2 13	2 03	1 53	1 44	1 37	1 31	1 25	1 19	1 15	1 10	1 07	4
8	9 46	8 54	8 09	7 31	6 58	6 29	6 03	5 40	5 18	5 00	4 44	4 27	8
12	21 59	20 01	18 20	16 55	15 40	14 34	13 36	12 44	11 58	11 15	10 38	10 02	12
16	39 05	35 35	32 36	30 05	27 52	25 54	24 12	22 40	21 14	20 01	18 54	17 50	16
20	...	55 36	50 56	47 00	43 32	40 28	37 48	35 24	33 12	31 16	29 32	27 52	20
24	...	...	...	...	62 41	58 16	54 26	50 59	47 48	45 02	42 31	40 08	24
28	...	...	...	...	...	79 19	74 05	69 23	65 03	61 17	57 54	54 37	28
32	...	...	...	...	...	...	...	...	...	80 02	75 37	71 20	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	9.16	8.34	7.64	7.05	6.53	6.07	5.67	5.31	4.98	4.69	4.43	4.18	Δ_1h
Log.	0.961 90	0.921 17	0.883 09	0.848 19	0.814 91	0.783 19	0.753 58	0.725 09	0.697 23	0.671 17	0.646 40	0.621 18	Log.
Limit	15	16	18	19	20	21	22	24	25	26	27	29	Minutes
Meridian	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 03	1 00	0 57	0 54	0 51	0 49	0 46	0 45	0 43	0 41	0 39	0 37	4
8	4 13	4 01	3 49	3 37	3 27	3 17	3 07	2 59	2 51	2 43	2 37	2 29	8
12	9 31	9 02	8 34	8 08	7 45	7 24	7 02	6 43	6 24	6 07	5 52	5 35	12
16	16 53	16 02	15 14	14 28	13 47	13 08	12 30	11 57	11 24	10 53	10 24	9 57	16
20	26 24	25 04	23 48	22 36	21 32	20 32	19 32	18 40	17 48	17 00	16 16	15 32	20
24	38 01	36 06	34 16	32 33	31 00	29 34	28 07	26 53	25 38	24 29	23 25	22 22	24
28	51 45	49 08	46 39	44 18	42 13	40 15	38 18	36 35	34 53	33 19	31 53	30 27	28
32	67 35	64 10	60 56	57 51	55 08	52 34	50 01	47 47	45 34	43 31	41 39	39 46	32
36	...	...	77 07	73 14	69 46	66 32	63 17	60 29	57 41	55 05	52 40	50 20	36
40	...	...	...	90 24	86 08	82 08	78 08	74 40	71 12	68 00	65 04	62 08	40
44	...	...	...	...	...	...	...	...	86 10	82 17	78 43	75 11	44
48	...	...	...	...	...	...	...	...	...	...	93 42	89 28	48
52	...	...	...	...	...	...	...	...	...	...	...	105 00	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	3.96	3.76	3.57	3.39	3.23	3.08	2.93	2.80	2.67	2.55	2.44	2.33	Δ_1h
Log.	0.597 70	0.575 19	0.552 67	0.530 20	0.509 20	0.488 55	0.466 87	0.447 16	0.426 51	0.406 54	0.387 39	0.367 36	Log.
Limit	30	31	32	33	34	35	36	37	38	39	40	41	Minutes
Meridian	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 34	0 33	0 31	0 30	0 28	0 27	0 27	0 25	0 24	0 22	0 22	4
8	2 23	2 16	2 11	2 05	2 00	1 55	1 50	1 45	1 41	1 36	1 32	1 28	8
12	5 21	5 06	4 54	4 43	4 29	4 18	4 06	3 56	3 46	3 36	3 24	3 17	12
16	9 31	9 06	8 42	8 21	7 59	7 38	7 18	7 00	6 42	6 24	6 06	5 51	16
20	14 52	14 12	13 36	13 04	12 28	11 56	11 24	10 56	10 28	10 00	9 32	9 08	20
24	21 24	20 27	19 35	18 49	17 57	17 11	16 25	15 45	15 04	14 24	13 43	13 09	24
28	29 09	27 50	26 39	25 37	24 26	23 24	22 21	21 25	20 31	19 36	18 42	17 54	28
32	38 04	36 21	34 49	33 27	31 55	30 33	29 11	27 59	26 48	25 36	24 25	23 23	32
36	48 10	46 01	44 04	42 20	40 24	38 40	36 56	35 26	33 55	32 24	30 53	29 36	36
40	59 28	56 48	54 24	52 16	49 52	47 44	45 36	43 44	41 52	40 00	38 08	36 32	40
44	71 57	68 44	65 49	63 14	60 21	57 45	55 10	52 55	50 40	48 24	46 08	44 13	44
48	85 38	81 46	78 20	75 16	71 48	68 42	65 38	62 58	60 17	57 36	54 55	52 36	48
52	100 30	95 59	91 56	88 20	84 16	80 40	77 04	73 54	70 45	67 36	64 27	61 44	52
56	...	.:.	106 37	102 26	97 45	93 33	89 22	85 43	82 04	78 24	74 44	71 37	56
60	...	...	...	...	112 12	107 24	102 36	98 24	94 12	90 00	85 48	82 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.23	2.13	2.04	1.96	1.87	1.79	1.71	1.64	1.57	1.50	1.43	1.37	$\triangle_1 h$
Log.	0.348 30	0.328 38	0.309 63	0.292 26	0.271 84	0.252 85	0.233 00	0.214 84	0.195 90	0.176 09	0.155 34	0.136 72	Log.
Limit	42	43	44	45	46	48	50	51	52	53	55	57	Minutes
Meridian	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 21	0 20	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 13	0 12	0 11	4
8	1 23	1 20	1 16	1 12	1 09	1 05	1 02	0 58	0 55	0 53	0 50	0 47	8
12	3 08	3 00	2 51	2 42	2 36	2 27	2 20	2 13	2 05	1 59	1 52	1 45	12
16	5 36	5 20	5 05	4 50	4 36	4 21	4 08	3 55	3 43	3 33	3 19	3 07	16
20	8 44	8 20	7 56	7 32	7 12	6 48	6 28	6 08	5 48	5 32	5 12	4 52	20
24	12 35	12 00	11 26	10 51	10 22	9 48	9 18	8 50	8 21	7 58	7 29	7 00	24
28	17 07	16 20	15 33	14 46	14 07	13 20	12 41	12 02	11 22	10 51	10 12	9 33	28
32	22 21	21 20	20 18	19 17	18 26	17 24	16 34	15 42	14 51	14 10	13 19	12 28	32
36	28 18	27 00	25 43	24 25	23 20	22 02	20 57	19 52	18 48	17 56	16 51	15 46	36
40	34 56	33 20	31 44	30 08	28 48	27 12	25 52	24 32	23 12	22 08	20 48	19 28	40
44	42 16	40 20	38 24	36 28	34 51	32 55	31 18	29 41	28 05	26 47	25 10	23 33	44
48	50 18	48 00	45 41	43 23	41 28	39 10	37 15	35 20	33 24	31 52	29 55	28 00	48
52	59 02	56 20	53 37	55 55	48 40	45 48	43 43	41 28	39 12	37 24	35 09	32 54	52
56	68 28	65 20	62 12	59 04	56 27	53 19	50 42	48 05	45 29	43 23	40 46	38 09	56
60	78 36	75 00	71 24	67 48	64 48	61 12	58 12	55 12	52 12	49 48	46 48	43 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.31	1.25	1.19	1.13	1.08	1.02	0.97	0.92	0.87	0.83	0.78	0.73	$\triangle_1 h$
Log.	0.117 27	0.096 91	0.075 55	0.053 08	0.033 42	0.008 60	9.986 77	9.963 79	9.939 52	9.919 08	9.892 09	9.863 32	Log.
Limit	59	60	62	64	66	68	70	72	74	76	78	80	Minutes
Meridian	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	Altitudes

Latitude 13° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 16	2 06	1 58	1 50	1 44	1 39	1 34	1 29	1 24	1 21	1 17	1 14	4
8	9 04	8 26	7 53	7 23	6 58	6 35	6 14	5 55	5 39	5 23	5 08	4 55	8
12	20 24	18 58	17 44	16 38	15 40	14 48	14 01	13 19	12 42	12 06	11 34	11 05	12
16	36 16	33 45	31 32	29 34	27 52	26 20	24 55	23 41	22 34	21 30	20 34	19 43	16
20	56 40	52 44	49 16	46 12	43 32	41 08	38 56	37 00	35 16	33 36	32 08	30 48	20
24	...	...	...	66 31	62 41	59 14	56 04	53 17	50 47	48 23	46 17	44 22	24
28	...	...	...	...	...	80 37	76 18	72 31	69 08	65 51	62 59	60 22	28
32	...	...	...	...	...	...	...	...	...	...	82 15	78 50	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	. .	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	. .	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	..	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	8.50	7.91	7.39	6.93	6.53	6.17	5.84	5.55	5.29	5.04	4.82	4.62	$\triangle_1 h$
Log.	0.929 42	0.898 18	0.868 64	0.840 73	0.814 91	0.790 29	0.766 41	0.744 29	0.723 46	0.702 43	0.683 05	0.664 64	Log.
Limit	16	17	18	19	20	21	22	23	24	25	26	27	Minutes
Meridian	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 10	1 08	1 05	1 03	1 00	0 59	0 56	0 54	0 53	0 51	0 49	0 48	4
8	4 44	4 32	4 22	4 12	4 03	3 54	3 46	3 39	3 31	3 24	3 18	3 12	8
12	10 38	10 12	9 49	9 28	9 06	8 47	8 28	8 11	7 55	7 39	7 25	7 12	12
16	18 54	18 08	17 27	16 48	16 10	15 37	15 04	14 33	14 05	13 37	13 11	12 48	16
20	29 32	28 20	27 16	26 16	25 16	24 24	23 32	22 44	22 02	21 16	20 36	20 00	20
24	42 31	40 48	39 16	37 49	36 23	35 09	33 53	32 44	31 41	30 38	29 40	28 48	24
28	57 54	55 32	53 27	51 29	49 32	47 49	46 08	44 34	43 07	41 41	40 23	39 12	28
32	75 37	72 32	69 48	67 15	64 41	62 27	60 15	58 12	56 19	54 26	52 44	51 12	32
36	...	...	...	...	...	79 04	76 15	73 39	71 17	68 55	66 45	64 48	36
40	...	...	...	...	...	...	...	90 56	88 00	85 04	82 24	80 00	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	..	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.43	4.25	4.09	3.94	3.79	3.66	3.53	3.41	3.30	3.19	3.09	3.00	$\triangle_1 h$
Log.	0.646 40	0.628 39	0.611 72	0.595 50	0.578 64	0.563 48	0.547 77	0.532 75	0.518 51	0.503 79	0.489 96	0.477 12	Log.
Limit	28	29	30	30	31	32	33	34	34	35	36	37	Minutes
Meridian	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	Altitudes

Latitude 13° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 46	0 45	0 43	0 43	0 41	0 40	0 38	0 38	0 36	0 35	0 35	0 34	4
8	3 05	3 00	2 55	2 49	2 45	2 40	2 36	2 31	2 27	2 23	2 19	2 15	8
12	6 58	6 46	6 33	6 21	6 10	6 00	5 50	5 40	5 30	5 21	5 12	5 03	12
16	12 22	12 02	11 39	11 19	10 58	10 40	10 22	10 04	9 46	9 31	9 16	9 01	16
20	19 20	18 48	18 12	17 40	17 08	16 40	16 12	15 44	15 16	14 52	14 28	14 04	20
24	27 50	27 05	26 12	25 27	24 40	24 00	23 19	22 40	21 59	21 24	20 50	20 16	24
28	37 54	36 51	35 41	34 37	33 35	32 40	31 46	30 50	29 56	29 09	28 21	27 34	28
32	49 30	48 07	46 36	45 13	43 52	42 40	41 29	40 16	39 05	38 04	37 02	36 00	32
36	62 38	60 55	58 58	57 15	55 31	54 00	52 29	50 59	49 28	48 10	46 53	45 35	36
40	77 20	75 12	72 48	70 40	68 32	66 40	64 48	62 56	61 04	59 28	57 52	56 16	40
44	...	...	88 05	85 31	82 56	80 40	78 24	76 09	73 53	71 57	70 02	68 05	44
48	...	...	...	...	...	96 00	93 19	90 37	87 56	85 38	83 19	81 01	48
52	...	...	...	...	...	...	...	106 21	103 12	100 30	97 47	95 05	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.90	2.82	2.73	2.65	2.57	2.50	2.43	2.36	2.29	2.23	2.17	2.11	$\Delta_1 h$
Log.	0.462 40	0.450 25	0.436 16	0.423 25	0.409 93	0.397 94	0.385 61	0.372 91	0.359 84	0.348 30	0.336 46	0.324 28	Log.
Limit	38	39	39	40	41	42	43	44	45	46	47	47	Minutes
Meridian	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 33	0 31	0 31	0 30	0 29	0 28	0 28	0 27	0 27	0 26	0 25	0 24	4
8	2 11	2 07	2 04	2 01	1 57	1 54	1 52	1 48	1 45	1 42	1 39	1 36	8
12	4 55	4 47	4 40	4 32	4 23	4 17	4 11	4 03	3 56	3 50	3 43	3 37	12
16	8 45	8 29	8 16	8 04	7 49	7 35	7 25	7 13	7 00	6 50	6 37	6 27	16
20	13 40	13 16	12 56	12 36	12 12	11 52	11 36	11 16	10 56	10 40	10 20	10 04	20
24	19 41	19 06	18 37	18 09	17 34	17 05	16 42	16 14	15 45	15 22	14 53	14 30	24
28	26 47	26 01	25 31	24 42	23 55	23 16	22 44	22 05	21 25	20 54	20 15	19 44	28
32	34 59	33 58	33 07	32 15	31 13	30 23	29 42	28 50	27 59	27 18	26 27	25 46	32
36	44 17	42 59	41 54	40 50	39 32	38 27	37 35	36 31	35 26	34 34	33 29	32 37	36
40	54 40	53 04	51 44	50 24	48 48	47 28	46 24	45 04	43 44	42 40	41 20	40 16	40
44	66 09	64 12	62 35	60 59	59 03	57 26	56 08	54 32	52 55	51 38	50 01	48 43	44
48	78 43	76 25	74 30	72 34	70 16	68 19	66 47	64 53	62 58	61 26	59 31	57 59	48
52	92 23	89 41	87 26	85 10	82 28	80 13	78 25	76 09	73 54	72 06	69 51	68 03	52
56	107 09	104 00	101 23	98 47	95 39	93 02	90 56	88 20	85 43	83 38	81 01	78 55	56
60	...	...	...	113 24	109 48	106 48	104 24	101 24	98 24	96 00	93 00	90 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.05	1.99	1.94	1.89	1.83	1.78	1.74	1.69	1.64	1.60	1.55	1.51	$\Delta_1 h$
Log.	0.311 75	0.298 85	0.287 80	0.276 46	0.262 45	0.250 42	0.240 55	0.227 89	0.214 84	0.204 12	0.190 33	0.178 98	Log.
Limit	48	49	50	51	51	52	53	54	55	56	57	58	Minutes
Meridian	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 22	0 22	0 22	0 21	0 20	0 19	0 19	0 19	0 18	0 17	0 17	4
8	1 34	1 31	1 28	1 26	1 23	1 21	1 18	1 15	1 13	1 11	1 08	1 07	8
12	3 31	3 25	3 19	3 13	3 07	3 02	2 56	2 50	2 45	2 39	2 34	2 30	12
16	6 13	6 03	5 53	5 43	5 33	5 22	5 12	5 02	4 55	4 45	4 34	4 26	16
20	9 44	9 28	9 12	8 56	8 40	8 24	8 08	7 52	7 40	7 24	7 08	6 56	20
24	14 01	13 38	13 15	12 52	12 29	12 06	11 43	11 20	11 03	10 40	10 16	9 59	24
28	19 05	18 34	18 02	17 30	16 59	16 28	15 57	15 25	15 01	14 30	13 59	13 35	28
32	24 55	24 14	23 33	22 52	22 11	21 30	20 49	20 08	19 37	18 56	18 16	17 45	32
36	31 32	30 40	29 49	28 57	28 05	27 13	26 21	25 30	24 51	23 59	23 07	22 28	36
40	38 56	37 52	36 48	35 44	34 40	33 36	32 32	31 28	30 40	29 36	28 32	27 44	40
44	47 06	45 49	44 32	43 14	41 57	40 39	39 22	38 05	37 07	35 49	34 32	33 33	44
48	56 04	54 32	52 59	51 27	49 55	48 23	46 51	45 18	44 09	42 37	41 05	39 56	48
52	65 48	64 00	62 11	60 23	58 35	56 47	54 29	53 10	51 49	50 01	48 13	46 52	52
56	76 18	74 13	72 08	70 02	67 57	65 51	63 46	61 41	60 07	58 01	55 56	54 21	56
60	87 36	85 12	82 48	80 24	78 00	75 36	73 12	70 48	69 00	66 36	64 12	62 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.46	1.42	1.38	1.34	1.30	1.26	1.22	1.18	1.15	1.11	1.07	1.04	$\triangle_1 h$
Log.	0.164 35	0.152 29	0.139 88	0.127 10	0.113 94	0.100 37	0.086 36	0.071 88	0.060 70	0.045 32	0.029 38	0.017 03	Log.
Limit	59	61	62	63	64	66	68	70	71	72	73	75	Minutes
Meridian	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 16	0 15	0 14	0 14	0 14	0 13	0 12	0 12	0 11	0 11	0 11	0 10	4
8	1 04	1 01	0 59	0 57	0 55	0 53	0 51	0 49	0 47	0 44	0 42	0 40	8
12	2 24	2 19	2 14	2 10	2 04	1 59	1 54	1 50	1 45	1 39	1 35	1 30	12
16	4 16	4 05	3 58	3 50	3 40	3 33	3 22	3 14	3 07	2 57	2 49	2 42	16
20	6 40	6 24	6 12	6 00	5 44	5 32	5 16	5 04	4 52	4 36	4 24	4 12	20
24	9 36	9 13	8 55	8 38	8 16	7 58	7 35	7 18	7 00	6 38	6 21	6 03	24
28	13 04	12 33	12 10	11 46	11 14	10 51	10 20	9 56	9 33	9 01	8 37	8 14	28
32	17 04	16 23	15 53	15 22	14 40	14 10	13 29	12 58	12 28	11 46	11 15	10 45	32
36	21 36	20 44	20 05	19 26	18 35	17 56	17 04	16 25	15 46	14 55	14 16	13 37	36
40	26 40	25 36	24 48	24 00	22 56	22 08	21 04	20 16	19 28	18 24	17 36	16 48	40
44	32 16	30 58	30 00	29 02	27 45	26 47	25 29	24 31	23 33	22 16	21 18	20 20	44
48	38 24	36 52	35 43	34 34	33 01	31 52	30 18	29 09	28 00	26 29	25 20	24 11	48
52	45 04	43 16	41 55	40 34	38 45	37 24	35 36	34 15	32 54	31 05	29 44	28 23	52
56	52 16	50 10	48 36	47 02	44 57	43 23	41 17	39 43	38 09	36 04	34 30	32 56	56
60	60 00	57 36	55 48	54 00	51 36	49 48	47 24	45 36	43 48	41 24	39 36	37 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.00	0.96	0.93	0.90	0.86	0.83	0.79	0.76	0.73	0.69	0.66	0.63	$\triangle_1 h$
Log.	0.00 ...	9.982 27	9.968 48	9.954 24	9.934 50	9.919 08	9.897 63	9.880 81	9.863 32	9.838 85	9.819 54	9.799 34	Log.
Limit	77	78	79	79	80	80	82	84	86	88	90	92	Minutes
Meridian	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	Altitudes

Latitude 14° Declination Same Name.

Declinations.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 06	2 15	2 27	2 39	2 55	3 15	3 38	4 08	4 49	5 45	...	...	4
8	8 24	9 03	9 46	10 38	11 40	12 56	14 31	16 33	19 15	23 02	...	...	8
12	18 55	20 20	21 59	23 56	26 16	29 06	32 39	37 15	...	...	...	...	12
16	33 37	36 08	39 05	42 32	46 40	...	...	...	...	...	...	...	16
20	52 32	56 28	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	7.88	8.47	9.16	9.97	10.94	12.13	13.61	15.52	18.05	21.59	...	...	$\triangle_1 h$
Log.	0.896 53	0.927 88	0.961 90	0.998 70	1.039 02	1.083 86	1.133 86	1.190 89	1.256 48	1.334 25	... ...	... ...	Log.
Limit	17	16	15	14	13	12	10	9	8	7	6	5	Minutes
Meridian	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	Altitudes

Declinations.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	5 31	4 35	3 53	3 23	2 59	4
8	...	...	...	...	...	...	...	22 03	18 16	15 34	13 32	11 58	8
12	...	...	...	...	...	...	...	...	...	35 01	30 27	26 54	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	20.67	17.13	14.59	12.69	11.21	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.315 34	1.233 76	1.164 06	1.103 46	1.049 61	Log.
Limit	3	1	0	2	4	6	7	8	9	11	12	13	Minutes
Meridian	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 40	2 25	2 12	2 01	1 51	1 43	1 35	1 29	1 23	1 18	1 14	1 10	4
8	10 41	9 39	8 48	8 03	7 24	6 53	6 23	5 56	5 35	5 14	4 55	4 38	8
12	24 03	21 43	19 47	18 07	16 41	15 28	14 23	13 21	12 33	11 47	11 05	10 26	12
16	42 45	38 37	35 09	32 13	29 39	27 28	25 33	23 43	22 19	20 57	19 43	18 34	16
20	...	...	54 56	50 20	46 20	42 56	39 56	37 04	34 52	32 44	30 48	29 00	20
24	...	...	...	...	66 43	61 49	57 30	53 23	50 12	47 08	44 22	41 46	24
28	...	...	...	...	...	84 09	78 17	72 39	68 21	64 10	60 22	56 50	28
32	...	...	...	...	...	...	...	...	...	...	78 50	74 14	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	....	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	10.02	9.05	8.24	7.55	6.95	6.44	5.99	5.56	5.23	4.91	4.62	4.35	$\triangle_1$h
Log.	1.000 87	0.956 65	0.915 93	0.877 95	0.841 98	0.808 89	0.777 43	0.745 07	0.718 50	0.691 08	0.664 64	0.638 49	Log.
Limit	14	15	17	18	19	20	22	23	24	25	26	28	Minutes
Meridian	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 06	1 02	0 59	0 56	0 53	0 51	0 48	0 46	0 44	0 42	0 40	0 38	4
8	4 23	4 09	3 56	3 44	3 33	3 23	3 13	3 04	2 56	2 47	2 40	2 33	8
12	9 51	9 20	8 51	8 24	7 59	7 36	7 15	6 53	6 35	6 17	6 00	5 44	12
16	17 33	16 36	15 45	14 56	14 13	13 32	12 53	12 15	11 41	11 11	10 40	10 12	16
20	27 24	25 56	24 36	23 20	22 12	21 08	20 08	19 08	18 16	17 28	16 40	15 56	20
24	39 28	37 21	35 26	33 36	31 58	30 26	29 00	27 33	26 18	25 10	24 00	22 57	24
28	53 42	50 50	48 13	45 44	43 31	41 25	39 28	37 30	35 48	34 14	32 40	31 14	28
32	70 08	66 23	62 58	59 44	56 50	54 06	51 32	48 59	46 46	44 42	42 40	40 47	32
36	...	...	79 43	75 36	71 56	68 29	65 14	62 00	59 11	56 36	54 00	51 38	36
40	...	...	...	...	88 48	84 32	80 32	76 32	73 04	69 52	66 40	63 44	40
44	...	...	...	...	...	...	...	...	88 24	84 33	80 40	77 07	44
48	...	...	...	...	...	...	...	...	...	...	96 00	91 46	48
52	...	...	...	...	...	...	...	...	...	...	...	107 42	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	4.11	3.89	3.69	3.50	3.33	3.17	3.02	2.87	2.74	2.62	2.50	2.39	$\triangle_1$h
Log.	0.613 84	0.589 95	0.567 03	0.544 07	0.522 44	0.501 06	0.480 01	0.457 88	0.437 75	0.418 30	0.397 94	0.378 40	Log.
Limit	29	30	31	32	33	34	35	36	37	38	39	40	Minutes
Meridian	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	Altitudes

Latitude 14° Declination Same Name.

Declinations.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 36	0 35	0 33	0 31	0 30	0 29	0 28	0 27	0 25	0 24	0 23	0 22	4
8	2 26	2 19	2 13	2 07	2 02	1 56	1 52	1 47	1 42	1 37	1 33	1 29	8
12	5 29	5 14	5 00	4 47	4 35	4 22	4 11	4 00	3 49	3 39	3 29	3 20	12
16	9 43	9 18	8 52	8 29	8 09	7 46	7 25	7 08	6 47	6 29	6 11	5 56	16
20	15 12	14 32	13 52	13 16	12 44	12 08	11 36	11 08	10 36	10 08	9 40	9 16	20
24	21 53	20 56	19 58	19 06	18 20	17 29	16 42	16 02	15 16	14 36	13 55	13 21	24
28	29 48	28 29	27 11	26 01	24 58	23 47	22 44	21 49	20 47	19 52	18 57	18 10	28
32	38 55	37 12	35 30	33 58	32 36	31 03	29 42	28 30	27 08	25 56	24 45	23 43	32
36	49 15	47 06	44 56	42 59	41 15	39 19	37 35	36 05	34 21	32 50	31 19	30 02	36
40	60 48	58 08	55 28	53 04	50 56	48 32	46 24	44 32	42 24	40 32	38 40	37 04	40
44	73 34	70 21	67 07	64 12	61 37	58 44	56 08	53 54	51 18	49 03	46 47	44 51	44
48	87 33	83 42	79 52	76 25	73 21	69 53	66 47	64 07	61 03	58 22	55 41	53 22	48
52	102 45	98 14	93 44	89 41	86 05	82 01	78 25	75 15	71 39	68 30	65 21	62 38	52
56	...	...	...	104 00	99 49	95 08	90 56	87 18	83 06	79 27	75 37	72 39	56
60	...	...	...	...	...	109 12	104 24	100 12	95 24	91 12	87 00	83 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.28	2.18	2.08	1.99	1.91	1.82	1.74	1.67	1.59	1.52	1.45	1.39	$\Delta_1 h$
Log.	0.357 93	0.338 46	0.318 06	0.298 85	0.281 03	0.260 07	0.240 55	0.222 72	0.201 40	0.181 84	0.161 37	0.143 01	Log.
Limit	41	42	43	44	46	47	49	50	51	52	54	56	Minutes
Meridian	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	Altitudes

Declinations.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 21	0 20	0 19	0 19	0 17	0 16	0 15	0 14	0 14	0 13	0 12	0 12	4
8	1 24	1 21	1 17	1 13	1 10	1 06	1 02	0 59	0 56	0 53	0 51	0 48	8
12	3 10	3 02	2 53	2 45	2 37	2 28	2 22	2 14	2 07	1 59	1 54	1 48	12
16	5 38	5 22	5 07	4 55	4 39	4 24	4 10	3 58	3 45	3 33	3 22	3 12	16
20	8 48	8 24	8 00	7 40	7 16	6 52	6 32	6 12	5 52	5 32	5 16	5 00	20
24	12 41	12 06	11 31	11 03	10 28	9 53	9 24	8 55	8 27	7 58	7 35	7 12	24
28	17 15	16 28	15 41	15 01	14 15	13 28	12 49	12 10	11 30	10 51	10 20	9 48	28
32	22 31	21 30	20 29	19 37	18 36	17 35	16 44	15 53	15 01	14 10	13 29	12 48	32
36	28 31	27 13	25 55	24 51	23 33	22 15	21 10	20 05	19 01	17 56	17 04	16 12	36
40	35 12	33 36	32 00	30 40	29 04	27 28	26 08	24 48	23 28	22 08	21 04	20 00	40
44	42 36	40 39	38 43	37 07	35 10	33 14	31 37	30 00	28 24	26 47	25 29	24 12	44
48	50 41	48 23	46 05	44 09	41 51	39 33	37 38	35 43	33 47	31 52	30 18	28 46	48
52	59 29	56 47	54 05	51 49	49 07	46 25	44 10	41 55	39 39	37 24	35 36	33 48	52
56	69 00	65 51	62 43	60 07	56 58	53 50	51 13	48 36	46 00	43 23	41 17	39 12	56
60	79 12	75 36	72 00	69 00	65 24	61 48	58 48	55 48	52 48	49 48	47 24	45 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.32	1.26	1.20	1.15	1.09	1.03	0.98	0.93	0.88	0.83	0.79	0.75	$\Delta_1 h$
Log.	0.120 57	0.100 37	0.079 18	0.060 70	0.037 43	0.012 84	9.991 23	9.968 48	9.944 48	9.919 08	9.897 63	9.875 06	Log.
Limit	58	60	62	64	66	67	69	71	73	75	77	79	Minutes
Meridian	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	Altitudes

Latitude 14° Declination Contrary Name.

DECLINATIONS. = δ

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
t = 4	2 06	1 58	1 50	1 44	1 39	1 33	1 29	1 24	1 21	1 17	1 14	1 10	4
8	8 24	7 51	7 22	6 57	6 33	6 13	5 55	5 38	5 23	5 08	4 55	4 44	8
12	18 55	17 40	16 35	15 37	14 45	13 59	13 18	12 41	12 06	11 34	11 03	10 38	12
16	33 37	31 24	29 29	27 47	26 15	24 53	23 38	22 31	21 30	20 34	19 41	18 54	16
20	52 32	49 04	46 04	43 24	41 00	38 52	36 56	35 12	33 36	32 08	30 44	29 32	20
24	...	...	66 20	62 30	59 03	55 58	53 11	50 41	48 23	46 17	44 16	42 31	24
28	...	...	...	...	80 21	76 11	72 23	69 00	65 51	62 59	60 14	57 54	28
32	...	...	...	...	...	...	...	...	...	82 15	78 40	75 37	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	7.88	7.36	6.91	6.51	6.15	5.83	5.54	5.28	5.04	4.82	4.61	4.43	$\triangle_1$h
Log.	0.896 53	0.866 88	0.839 48	0.813 58	0.788 88	0.765 67	0.743 51	0.722 63	0.702 43	0.683 05	0.663 70	0.646 40	Log.
Limit	17	18	19	20	21	22	23	24	25	26	27	28	Minutes
Meridian	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 08	1 05	1 03	1 01	0 59	0 57	0 54	0 53	0 51	0 50	0 48	0 46	4
8	4 32	4 22	4 12	4 03	3 54	3 47	3 39	3 32	3 25	3 18	3 13	3 06	8
12	10 12	9 49	9 28	9 07	8 47	8 30	8 13	7 56	7 41	7 26	7 13	6 59	12
16	18 08	17 27	16 48	16 13	15 37	15 06	14 35	14 08	13 39	13 14	12 51	12 25	16
20	28 20	27 16	26 16	25 20	24 24	23 36	22 48	22 04	21 20	20 40	20 04	19 24	20
24	40 48	39 16	37 49	36 29	35 09	33 59	32 50	31 47	30 43	29 46	28 54	27 56	24
28	55 32	53 27	51 29	49 39	47 49	46 15	44 42	43 15	41 49	40 30	39 20	38 02	28
32	72 32	69 48	67 15	64 51	62 27	60 25	58 22	56 29	54 37	52 54	51 22	49 40	32
36	...	...	...	...	79 04	76 28	73 52	71 30	69 07	66 58	65 01	62 51	36
40	...	...	...	...	...	...	91 12	88 16	85 20	82 40	80 16	77 36	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	4.25	4.09	3.94	3.80	3.66	3.54	3.42	3.31	3.20	3.10	3.01	2.91	$\triangle_1$h
Log.	0.628 39	0.611 72	0.595 50	0.579 78	0.563 48	0.549 00	0.534 03	0.519 83	0.505 15	0.491 36	0.478 57	0.463 89	Log.
Limit	29	30	31	31	32	33	34	35	35	36	37	38	Minutes
Meridian	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	Altitudes

Latitude 14° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 45	0 44	0 43	0 41	0 40	0 39	0 38	0 37	0 36	0 35	0 34	0 33	4
8	3 01	2 56	2 50	2 46	2 41	2 37	2 32	2 28	2 24	2 19	2 16	2 13	8
12	6 47	6 35	6 23	6 13	6 01	5 52	5 43	5 32	5 24	5 14	5 06	4 58	12
16	12 05	11 41	11 21	11 03	10 43	10 24	10 09	9 52	9 36	9 18	9 06	8 50	16
20	18 52	18 16	17 44	17 16	16 44	16 16	15 52	15 24	15 00	14 32	14 12	13 48	20
24	27 10	26 18	25 33	24 52	24 06	23 25	22 51	22 11	21 36	20 56	20 27	19 52	24
28	36 59	35 48	34 45	33 51	32 48	31 53	31 06	30 11	29 24	28 29	27 50	27 03	28
32	48 18	46 46	45 23	44 12	42 50	41 39	40 37	39 25	38 24	37 12	36 21	35 20	32
36	61 08	59 11	57 28	55 57	54 13	52 42	51 25	49 54	48 36	47 06	46 01	44 43	36
40	75 28	73 04	70 56	69 04	66 56	65 04	63 28	61 36	60 00	58 08	56 48	55 12	40
44	...	88 24	85 50	83 34	80 59	78 43	76 48	74 32	72 36	70 21	68 44	66 48	44
48	...	...	...	...	96 23	93 42	91 23	88 42	86 24	83 42	81 46	79 29	48
52	...	...	...	...	...	...	107 15	104 06	101 24	98 14	95 59	93 17	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1h$	2.83	2.74	2.66	2.59	2.51	2.44	2.38	2.31	2.25	2.18	2.13	2.07	$\triangle_1h$
Log	0.451 79	0.437 75	0.424 88	0.413 20	0.399 67	0.387 39	0.376 58	0.363 61	0.352 18	0.338 46	0.328 38	0.315 97	Log.
Limit	39	39	40	41	42	43	44	44	45	46	47	48	Minutes
Meridian	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 32	0 31	0 30	0 30	0 29	0 28	0 27	0 27	0 26	0 25	0 24	0 23	4
8	2 09	2 05	2 02	1 58	1 55	1 52	1 50	1 46	1 43	1 41	1 38	1 36	8
12	4 49	4 43	4 35	4 26	4 19	4 12	4 06	3 59	3 53	3 46	3 40	3 35	12
16	8 35	8 21	8 09	7 54	7 41	7 28	7 18	7 05	6 55	6 42	6 32	6 21	16
20	13 24	13 04	12 44	12 20	12 00	11 40	11 24	11 04	10 48	10 28	10 12	9 56	20
24	19 18	18 49	18 20	17 46	17 17	16 48	16 25	15 57	15 34	15 04	14 41	14 18	24
28	26 16	25 37	24 58	24 10	23 31	22 52	22 21	21 41	21 10	20 31	20 00	19 29	28
32	34 18	33 27	32 36	31 34	30 43	29 52	29 11	28 19	27 38	26 48	26 07	25 26	32
36	43 25	42 20	41 15	39 58	38 53	37 48	36 56	35 52	35 00	33 55	33 03	32 11	36
40	53 36	52 16	50 56	49 20	48 00	46 40	45 36	44 16	43 12	41 52	40 48	39 44	40
44	64 51	63 14	61 37	59 42	58 05	56 28	55 10	53 34	52 17	50 40	49 22	48 04	44
48	77 11	75 16	73 21	71 02	69 07	67 10	65 38	63 44	62 12	60 17	58 45	57 13	48
52	90 35	88 20	86 05	83 22	81 07	78 52	77 04	74 48	73 00	70 45	68 57	67 09	52
56	105 03	102 26	99 49	96 42	94 05	91 28	89 22	86 46	84 41	82 04	79 58	77 52	56
60	...	...	114 36	111 00	108 00	105 00	102 36	99 36	97 12	94 12	91 48	89 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1h$	2.01	1.96	1.91	1.85	1.80	1.75	1.71	1.66	1.62	1.57	1.53	1.49	$\triangle_1A$
Log.	0.303 20	0.292 26	0.281 03	0.267 17	0.255 27	0.243 04	0.233 00	0.220 11	0.209 52	0.195 90	0.184 69	0.173 19	Log.
Limit	49	50	51	52	52	53	54	55	56	56	57	58	Minutes
Meridian	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 21	0 20	0 20	0 19	0 19	0 18	0 18	0 17	0 16	4
8	1 33	1 30	1 27	1 24	1 22	1 20	1 17	1 15	1 12	1 10	1 08	1 06	8
12	3 28	3 22	3 16	3 10	3 05	3 00	2 54	2 48	2 42	2 38	2 33	2 28	12
16	6 08	5 58	5 48	5 38	5 27	5 20	5 10	5 00	4 50	4 42	4 31	4 24	16
20	9 36	9 20	9 04	8 48	8 32	8 20	8 04	7 48	7 32	7 20	7 04	6 52	20
24	13 49	13 26	13 04	12 41	12 17	12 00	11 37	11 14	10 51	10 34	10 11	9 53	24
28	18 49	18 18	17 46	17 15	16 44	16 20	15 49	15 17	14 46	14 22	13 51	13 28	28
32	24 35	23 54	23 12	22 31	21 51	21 20	20 39	19 58	19 17	18 46	18 05	17 35	32
36	31 06	30 14	29 23	28 31	27 39	27 00	26 08	25 17	24 25	23 46	22 54	22 15	36
40	38 24	37 20	36 16	35 12	34 08	33 20	32 16	31 12	30 08	29 20	28 16	27 28	40
44	46 27	45 10	43 53	42 36	41 18	40 20	39 02	37 46	36 28	35 30	34 12	33 14	44
48	55 18	53 46	52 13	50 41	49 09	48 00	46 28	44 55	43 23	42 14	40 42	39 33	48
52	64 54	63 06	61 17	59 29	57 41	56 20	54 32	52 43	55 55	49 34	47 46	46 25	52
56	75 15	73 10	71 05	69 00	66 54	65 20	63 14	61 10	59 04	57 30	55 24	53 50	56
60	86 24	84 00	81 36	79 12	76 48	75 00	72 36	70 12	67 48	66 00	63 36	61 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.44	1.40	1.36	1.32	1.28	1.25	1.21	1.17	1.13	1.10	1.06	1.03	$\triangle_1 h$
Log.	0.158 36	0.146 13	0.133 54	0.120 57	0.107 21	0.096 91	0.082 79	0.068 19	0.053 08	0.041 39	0.025 31	0.012 84	Log.
Limit	60	62	63	65	66	67	69	71	72	73	74	75	Minutes
Meridian	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 15	0 14	0 14	0 14	0 13	0 12	0 12	0 11	0 11	0 11	0 10	4
8	1 03	1 01	0 58	0 57	0 54	0 52	0 51	0 48	0 46	0 43	0 41	0 39	8
12	2 23	2 19	2 13	2 08	2 02	1 58	1 54	1 48	1 44	1 37	1 33	1 29	12
16	4 13	4 05	3 55	3 48	3 38	3 30	3 22	3 12	3 04	2 54	2 47	2 39	16
20	6 36	6 24	6 08	5 56	5 40	5 28	5 16	5 00	4 48	4 32	4 20	4 08	20
24	9 30	9 13	8 50	8 33	8 10	7 53	7 35	7 12	6 55	6 32	6 15	5 58	24
28	12 57	12 33	12 02	11 38	11 06	10 43	10 20	9 48	9 25	8 53	8 29	8 06	28
32	16 54	16 23	15 42	15 11	14 30	13 59	13 29	12 48	12 17	11 36	11 05	10 34	32
36	21 23	20 44	19 52	19 14	18 22	17 43	17 04	16 12	15 33	14 42	14 03	13 24	36
40	26 24	25 36	24 32	23 44	22 40	21 52	21 04	20 00	19 12	18 08	17 20	16 32	40
44	31 56	30 58	29 41	28 43	27 26	26 28	25 29	24 12	23 14	21 57	20 59	20 01	44
48	38 01	36 52	35 20	34 10	32 38	31 29	30 18	28 46	27 37	26 06	24 57	23 48	48
52	44 37	43 16	41 28	40 06	38 18	36 57	35 36	33 48	32 27	30 38	29 17	27 56	52
56	51 44	50 10	48 05	46 31	44 26	42 52	41 17	39 12	37 38	35 33	33 59	32 25	56
60	59 24	57 36	55 12	53 24	51 00	49 12	47 24	45 00	43 12	40 48	39 00	37 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.99	0.96	0.92	0.89	0.85	0.82	0.79	0.75	0.72	0.68	0.65	0.62	$\triangle_1 h$
Log.	9.995 64	9.982 27	9.963 79	9.949 39	9.929 42	9.913 81	9.897 63	9.875 06	9.857 33	9.832 51	9.812 91	9.792 39	Log.
Limit	77	78	79	79	80	80	82	84	86	88	90	92	Minutes
Meridian	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	Altitudes

Latitude 15° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 57	2 06	2 14	2 26	2 38	2 54	3 13	3 37	4 06	4 46	5 43	...	4
8	7 49	8 22	9 00	9 43	10 34	11 36	12 52	14 26	16 27	19 06	22 52	...	8
12	17 35	18 49	20 14	21 51	23 49	26 07	28 57	32 28	36 59	...	...	...	12
16	31 17	33 27	35 58	38 53	42 19	46 25	...	...	...	...	...	...	16
20	48 52	52 16	56 12	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	7.33	7.84	8.43	9.11	9.92	10.88	12.06	13.53	15.41	17.92	21.43	...	$\triangle_1$h
Log.	0.865 10	0.894 32	0.925 83	0.959 52	0.996 51	1.036 63	1.081 35	1.131 30	1.187 80	1.253 34	1.331 02	... ...	Log.
Limit	19	18	17	16	15	14	12	11	10	9	8	6	Minutes
Meridian	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	5 27	4 31	3 51	3 21	4
8	...	...	...	...	...	...	...	...	21 49	18 04	15 24	13 23	8
12	...	...	...	...	...	...	...	...	...	40 40	34 38	30 06	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	...	...	...	...	20.45	16.94	14.43	12.54	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.310 69	1.228 91	1.159 27	1.098 30	Log.
Limit	5	3	1	0	2	4	6	7	8	10	11	12	Minutes
Meridian	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	Altitudes

Latitude 15° Declination Same Name.

Declinations.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 57	2 38	2 22	2 10	1 59	1 50	1 42	1 34	1 28	1 23	1 17	1 13	4
8	11 50	10 33	9 31	8 40	7 57	7 19	6 46	6 17	5 52	5 29	5 09	4 51	8
12	26 36	23 46	21 26	19 30	17 52	16 28	15 14	14 10	13 12	12 21	11 35	10 54	12
16	...	42 14	38 06	34 42	31 44	29 16	27 06	25 10	23 28	21 59	20 37	19 22	16
20	...	...	...	54 12	49 36	45 44	42 20	39 20	36 40	34 20	32 12	30 16	20
24	...	...	...	...	...	65 52	60 58	56 38	52 48	49 27	46 22	43 35	24
28	...	...	...	...	...	...	82 59	77 06	71 52	67 17	63 07	59 19	28
32	...	...	...	...	...	...	...	...	...	...	82 26	77 29	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	11.08	9.90	8.93	8.13	7.44	6.86	6.35	5.90	5.50	5.15	4.83	4.54	$\triangle_1 h$
Log.	1.044 54	0.995 64	0.950 85	0.910 09	0.871 57	0.836 32	0.802 77	0.770 85	0.740 36	0.711 81	0.683 95	0.657 06	Log.
Limit	13	14	16	17	18	20	21	22	24	25	26	27	Minutes
Meridian	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	Altitudes

Declinations.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 08	1 05	1 01	0 58	0 55	0 52	0 50	0 47	0 45	0 43	0 41	0 39	4
8	4 34	4 19	4 05	3 51	3 41	3 30	3 18	3 09	3 00	2 51	2 44	2 37	8
12	10 17	9 42	9 10	8 41	8 16	7 51	7 26	7 05	6 44	6 26	6 09	5 52	12
16	18 15	17 14	16 18	15 27	14 40	13 57	13 14	12 35	12 00	11 26	10 55	10 24	16
20	28 32	26 56	25 28	24 08	22 56	21 48	20 40	19 40	18 44	17 52	17 04	16 16	20
24	41 05	38 47	36 41	34 46	33 01	31 23	29 46	28 19	26 59	25 44	24 35	23 25	24
28	55 56	52 47	49 55	47 18	44 57	42 44	40 30	38 33	36 43	35 01	33 27	31 53	28
32	73 03	68 57	65 11	61 46	58 43	55 49	52 54	50 21	47 57	45 44	43 41	41 39	32
36	...	...	...	78 12	74 18	70 38	66 58	63 43	60 42	57 54	55 18	52 42	36
40	...	...	...	...	91 44	87 12	82 40	78 40	74 56	71 28	68 16	65 04	40
44	...	...	...	...	...	...	...	...	...	86 29	82 36	78 43	44
48	...	...	...	...	...	...	...	...	...	...	...	93 42	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.28	4.04	3.82	3.62	3.44	3.27	3.10	2.95	2.81	2.68	2.56	2.44	$\triangle_1 h$
Log.	0.631 44	0.606 38	0.582 06	0.558 71	0.536 56	0.514 55	0.491 36	0.469 82	0.448 71	0.428 13	0.408 24	0.387 39	Log.
Limit	28	29	30	31	33	34	35	36	37	38	39	40	Minutes
Meridian	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	Altitudes

Latitude 15° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 37	0 35	0 34	0 32	0 31	0 30	0 28	0 27	0 26	0 25	0 23	0 22	4
8	2 29	2 23	2 16	2 10	2 04	1 58	1 54	1 48	1 43	1 39	1 34	1 30	8
12	5 35	5 21	5 06	4 52	4 40	4 26	4 16	4 03	3 53	3 42	3 32	3 23	12
16	9 57	9 31	9 06	8 40	8 16	7 54	7 33	7 13	6 55	6 34	6 16	6 01	16
20	15 32	14 52	14 12	13 32	12 56	12 20	11 48	11 16	10 48	10 16	9 48	9 24	20
24	22 22	21 24	20 27	19 29	18 37	17 46	16 59	16 14	15 34	14 47	14 06	13 32	24
28	30 27	29 09	27 50	26 32	25 21	24 10	23 08	22 05	21 10	20 07	19 13	18 26	28
32	39 46	38 04	36 21	34 39	33 07	31 34	30 13	28 50	27 38	26 17	25 06	24 04	32
36	50 20	48 10	46 01	43 51	41 54	39 58	38 14	36 31	35 00	33 16	31 45	30 27	36
40	62 08	59 28	56 48	54 08	51 44	49 20	47 12	45 04	43 12	41 04	39 12	37 36	40
44	75 11	71 57	68 44	65 30	62 35	59 42	57 07	54 32	52 17	49 41	47 26	45 29	44
48	89 28	85 38	81 46	77 57	74 30	71 02	67 56	64 53	62 12	59 08	56 27	54 09	48
52	105 00	100 30	95 59	91 29	87 26	83 22	79 46	76 09	73 00	69 24	66 15	63 33	52
56	. . .	. . .	. . .	106 06	101 23	96 42	92 31	88 20	84 41	80 29	76 50	73 41	56
60	. . .	. . .	. . .	. . .	. . .	111 00	106 12	101 24	97 12	92 24	88 12	84 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.33	2.23	2.13	2.03	1.94	1.85	1.77	1.69	1.62	1.54	1.47	1.41	△₁h
Log.	0.367 36	0.348 30	0.328 38	0.307 50	0.287 80	0.267 17	0.247 97	0.227 89	0.209 52	0.187 52	0.167 32	0.149 22	Log.
Limit	41	42	43	43	45	46	48	49	50	51	53	55	Minutes
Altitudes	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 20	0 19	0 19	0 18	0 17	0 15	0 15	0 14	0 14	0 12	0 12	4
8	1 26	1 22	1 18	1 14	1 10	1 07	1 03	1 00	0 57	0 54	0 51	0 47	8
12	3 13	3 05	2 56	2 47	2 38	2 30	2 23	2 16	2 08	2 01	1 54	1 47	12
16	5 43	5 27	5 12	4 57	4 42	4 26	4 13	4 00	3 48	3 35	3 22	3 09	16
20	8 56	8 32	8 08	7 44	7 20	6 56	6 36	6 16	5 56	5 36	5 16	4 56	20
24	12 52	12 17	11 43	11 09	10 34	9 59	9 30	9 01	8 33	8 04	7 35	7 06	24
28	17 30	16 44	15 57	15 09	14 22	13 35	12 57	12 17	11 38	10 58	10 20	9 40	28
32	22 52	21 51	20 49	19 47	18 46	17 45	16 54	16 03	15 11	14 20	13 29	12 38	32
36	28 57	27 39	26 21	25 04	23 46	22 28	21 23	20 18	19 14	18 09	17 04	15 59	36
40	35 44	34 08	32 32	30 56	29 20	27 44	26 24	25 04	23 44	22 24	21 04	19 44	40
44	43 14	41 18	39 22	37 26	35 30	33 33	31 56	30 19	28 43	27 06	25 29	23 52	44
48	51 27	49 09	46 51	44 32	42 14	39 56	38 01	36 06	34 10	32 15	30 18	28 23	48
52	60 23	57 41	54 59	52 16	49 34	46 52	44 37	42 22	40 06	37 51	35 36	33 21	52
56	70 02	66 54	63 46	60 38	57 30	54 21	51 44	49 07	46 31	43 54	41 17	38 40	56
60	80 24	76 48	73 12	69 36	66 00	62 24	59 24	56 24	53 24	50 24	47 24	44 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.34	1.28	1.22	1.16	1.10	1.04	0.99	0.94	0.89	0.84	0.79	0.74	△₁h
Log.	0.127 10	0.107 21	0.086 36	0.064 46	0.041 39	0.017 03	9.995 64	9.973 13	9.949 39	9.924 28	9.897 63	9.869 23	Log.
Limit	57	59	61	63	65	67	69	71	73	75	77	79	Minutes
Meridian	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 57	1 50	1 43	1 38	1 33	1 28	1 24	1 20	1 17	1 14	1 10	1 08	4
8	7 49	7 20	6 55	6 32	6 12	5 53	5 37	5 22	5 08	4 55	4 43	4 32	8
12	17 35	16 31	15 34	14 42	13 56	13 15	12 38	12 04	11 32	11 03	10 37	10 12	12
16	31 17	29 21	27 38	26 10	24 48	23 33	22 26	21 28	20 32	19 41	18 51	18 08	16
20	48 52	45 52	43 12	40 52	38 44	36 48	35 04	33 32	32 04	30 44	29 28	28 20	20
24	...	66 03	62 12	58 51	55 47	53 00	50 30	48 17	46 11	44 16	42 26	40 48	24
28	...	...	...	80 06	75 55	72 08	68 44	65 44	62 51	60 14	57 46	55 32	28
32	...	...	...	...	...	...	...	...	82 05	78 40	75 26	72 32	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	7.33	6.88	6.48	6.13	5.81	5.52	5.26	5.03	4.81	4.61	4.42	4.25	$\triangle_1 h$
Log.	0.865 10	0.837 59	0.811 58	0.787 46	0.764 18	0.741 94	0.720 99	0.701 57	0.682 15	0.663 70	0.645 42	0.628 39	Log.
Limit	18	19	20	21	22	23	24	25	26	27	28	29	Minutes
Meridian	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 05	1 03	1 01	0 59	0 57	0 54	0 53	0 51	0 50	0 48	0 46	0 46	4
8	4 22	4 12	4 03	3 54	3 47	3 39	3 32	3 26	3 19	3 13	3 06	3 02	8
12	9 49	9 28	9 07	8 47	8 30	8 13	7 56	7 42	7 27	7 13	7 01	6 49	12
16	17 27	16 48	16 13	15 37	15 06	14 35	14 08	13 42	13 17	12 51	12 27	12 07	16
20	27 16	26 16	25 20	24 24	23 36	22 48	22 04	21 24	20 44	20 04	19 28	18 56	20
24	39 16	37 49	36 29	35 09	33 59	32 50	31 47	30 49	29 52	28 54	28 02	27 16	24
28	53 27	51 29	49 39	47 49	46 15	44 42	43 15	41 57	40 39	39 20	38 10	37 06	28
32	69 48	67 15	64 51	62 27	60 25	58 22	56 29	44 47	53 04	51 22	49 50	48 28	32
36	...	...	...	79 04	76.28	73 52	71 30	69 20	67 11	65 01	63 04	61 21	36
40	...	...	...	...	...	91 12	88 16	85 36	82 56	80 16	77 52	75 44	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.09	3.94	3.80	3.66	3.54	3.42	3.31	3.21	3.11	3.01	2.92	2.84	$\triangle_1 h$
Log.	0.611 72	0.595 50	0.579 78	0.563 48	0.549 00	0.534 03	0.519 83	0.506 51	0.492 76	0.478 57	0.465 38	0.453 32	Log.
Limit	30	31	32	32	33	34	35	35	35	36	37	38	Minutes
Meridian	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 44	0 43	0 42	0 40	0 39	0 38	0 37	0 36	0 35	0 35	0 33	0 32	4
8	2 56	2 51	2 46	2 42	2 38	2 33	2 28	2 25	2 21	2 17	2 13	2 10	8
12	6 36	6 24	6 14	6 04	5 55	5 44	5 34	5 26	5 17	5 08	5 00	4 52	12
16	11 44	11 24	11 06	10 48	10 29	10 12	9 54	9 38	9 23	9 08	8 52	8 40	16
20	18 20	17 48	17 20	16 52	16 24	15 56	15 28	15 04	14 40	14 16	13 52	13 32	20
24	26 24	25 38	24 58	24 17	23 37	22 57	22 17	21 42	21 07	20 33	19 58	19 29	24
28	35 56	34 53	33 58	33 04	32 09	31 14	30 19	29 32	28 45	27 57	27 11	26 32	28
32	46 56	45 34	44 22	43 11	41 59	40 47	39 35	38 34	37 33	36 31	35 30	34 39	32
36	59 24	57 41	56 10	54 39	53 08	51 38	50 07	48 49	47 31	46 14	44 56	43 51	36
40	73 20	71 12	69 20	67 28	65 36	63 44	61 52	60 16	58 40	57 04	55 28	54 08	40
44	88 44	86 10	83 54	81 38	79 22	77 07	74 52	72 55	70 59	69 03	67 07	65 30	44
48	...	...	99 50	97 09	94 28	91 46	89 05	86 47	84 29	82 10	79 52	77 57	48
52	...	...	...	...	...	107 42	104 33	101 51	99 09	96 26	93 44	91 29	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	2.75	2.67	2.60	2.53	2.46	2.39	2.32	2.26	2.20	2.14	2.08	2.03	Δ_1h
Log.	0.439 33	0.426 51	0.414 97	0.403 12	0.390 94	0.378 40	0.365 49	0.354 11	0.342 42	0.330 41	0.318 06	0.307 50	Log.
Limit	39	40	41	42	43	44	45	45	46	47	48	49	Minutes
Meridian	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 30	0 30	0 29	0 28	0 27	0 27	0 26	0 25	0 25	0 24	0 23	4
8	2 05	2 02	2 00	1 56	1 54	1 50	1 47	1 44	1 42	1 39	1 36	1 34	8
12	4 44	4 37	4 29	4 22	4 16	4 08	4 02	3 54	3 49	3 43	3 37	3 31	12
16	8 24	8 11	7 59	7 46	7 33	7 20	7 10	6 58	6 47	6 37	6 27	6 13	16
20	13 08	12 48	12 28	12 08	11 48	11 28	11 12	10 52	10 36	10 20	10 04	9 44	20
24	18 54	18 26	17 57	17 29	16 59	16 31	16 08	15 39	15 16	14 53	14 30	14 01	24
28	25 45	25 06	24 26	23 47	23 08	22 29	21 57	21 18	20 47	20 15	19 44	19 05	28
32	33 38	32 46	31 55	31 03	30 13	29 21	28 40	27 49	27 08	26 27	25 46	24 55	32
36	42 33	41 28	40 24	39 19	38 14	37 09	36 18	35 13	34 21	33 29	32 37	31 32	36
40	52 32	51 12	49 52	48 32	47 12	45 52	44 48	43 28	42 24	41 20	40 16	38 56	40
44	63 34	61 57	60 21	58 44	57 07	55 30	54 13	52 36	51 18	50 01	48 43	47 06	44
48	75 39	73 44	71 48	69 53	67 56	66 01	64 30	62 35	61 03	59 31	57 59	56 04	48
52	88 47	86 32	84 16	82 01	79 46	77 31	75 42	73 27	71 39	69 51	68 03	65 48	52
56	102 57	100 21	97 45	95 08	92 31	89 54	87 49	85 12	83 06	81 01	78 55	76 18	56
60	...	...	112 12	109 12	106 12	103 12	100 48	97 48	95 24	93 00	90 36	87 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.97	1.92	1.87	1.82	1.77	1.72	1.68	1.63	1.59	1.55	1.51	1.46	Δ_1h
Log.	0.294 47	0.283 30	0.271 84	0.260 07	0.247 97	0.235 53	0.225 31	0.212 19	0.201 40	0.190 33	0.178 98	0.164 35	Log.
Limit	50	51	52	52	53	54	55	56	57	58	59	60	Minutes
Meridian	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 21	0 20	0 19	0 19	0 19	0 18	0 17	0 17	0 16	4
8	1 31	1 28	1 26	1 23	1 21	1 19	1 16	1 13	1 11	1 10	1 07	1 05	8
12	3 25	3 19	3 14	3 08	3 03	2 57	2 51	2 45	2 41	2 37	2 31	2 27	12
16	6 03	5 53	5 46	5 36	5 25	5 15	5 05	4 55	4 47	4 39	4 29	4 21	16
20	9 28	9 12	9 00	8 44	8 28	8 12	7 56	7 40	7 28	7 16	7 00	6 48	20
24	13 38	13 15	12 58	12 35	12 11	11 48	11 26	11 03	10 46	10 28	10 05	9 48	24
28	18 34	18 02	17 38	17 07	16 36	16 05	15 33	15 01	14 38	14 15	13 43	13 20	28
32	24 14	23 33	23 02	22 21	21 41	21 00	20 18	19 37	19 06	18 36	17 55	17 24	32
36	30 40	29 49	29 10	28 18	27 26	26 34	25 43	24 51	24 12	23 33	22 41	22 02	36
40	37 52	36 48	36 00	34 56	33 52	32 48	31 44	30 40	29 52	29 04	28 00	27 12	40
44	45 49	44 32	43 34	42 16	40 59	39 41	38 24	37 07	36 09	35 10	33 53	32 55	44
48	54 32	52 59	51 50	50 18	48 46	47 14	45 41	44 09	43 00	41 51	40 19	39 10	48
52	64 00	62 11	60 50	59 02	57 14	55 26	53 37	51 49	50 28	49 07	47 19	45 58	52
56	74 13	72 08	70 34	68 28	66 23	64 17	62 12	60 07	58 33	56 58	54 53	53 19	56
60	85 12	82 48	81 00	78 36	76 12	73 48	71 24	69 00	67 12	65 24	63 00	61 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.42	1.38	1.35	1.31	1.27	1.23	1.19	1.15	1.12	1.09	1.05	1.02	$\Delta_1 h$
Log.	0.152 29	0.139 88	0.130 33	0.117 27	0.103 80	0.089 91	0.075 55	0.060 70	0.049 22	0.037 43	0.021 19	0.008 60	Log.
Limit	61	63	64	65	67	68	70	72	73	74	75	76	Minutes
Meridian	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 15	0 14	0 14	0 14	0 13	0 12	0 12	0 11	0 11	0 11	0 10	4
8	1 02	1 01	0 58	0 56	0 54	0 51	0 50	0 47	0 45	0 43	0 41	0 39	8
12	2 22	2 17	2 11	2 07	2 02	1 56	1 52	1 47	1 42	1 37	1 33	1 29	12
16	4 10	4 03	3 53	3 45	3 38	3 28	3 19	3 09	3 02	2 54	2 47	2 39	16
20	6 32	6 20	6 04	5 52	5 40	5 24	5 12	4 56	4 44	4 32	4 20	4 08	20
24	9 24	9 07	8 44	8 27	8 10	7 47	7 29	7 06	6 49	6 32	6 15	5 58	24
28	12 49	12 25	11 54	11 30	11 06	10 35	10 12	9 40	9 17	8 53	8 29	8 06	28
32	16 44	16 13	15 32	15 01	14 30	13 49	13 19	12 38	12 07	11 36	11 05	10 34	32
36	21 10	20 31	19 39	19 01	18 22	17 30	16 51	15 59	15 20	14 42	14 03	13 24	36
40	26 08	25 20	24 16	23 28	22 40	21 36	20 48	19 44	18 56	18 08	17 20	16 32	40
44	31 37	30 39	29 21	28 24	27 26	26 08	25 10	23 52	22 54	21 57	20 59	20 01	44
48	37 38	36 29	34 57	33 47	32 38	31 06	29 55	28 23	27 14	26 06	24 57	23 48	48
52	44 10	42 49	41 01	39 39	38 18	36 30	35 09	33 21	32 00	30 38	29 17	27 56	52
56	51 13	49 39	47 33	46 00	44 26	42 20	40 46	38 40	37 06	35 33	33 59	32 25	56
60	58 48	57 00	54 36	52 48	51 00	48 36	46 48	44 24	42 36	40 48	39 00	37 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.98	0.95	0.91	0.88	0.85	0.81	0.78	0.74	0.71	0.68	0.65	0.62	$\Delta_1 h$
Log.	9.991 23	9.977 72	9.959 04	9.944 48	9.929 42	9.908 49	9.892 09	9.869 23	9.851 26	9.832 51	9.812 91	9.792 39	Log.
Limit	78	79	79	80	80	80	82	84	86	88	90	92	Minutes
Meridian	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	Altitudes

Latitude 16° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 50	1 56	2 05	2 14	2 25	2 38	2 53	3 11	3 35	4 05	4 43	5 40	4
8	7 18	7 47	8 19	8 56	9 40	10 30	11 32	12 46	14 20	16 19	18 58	22 41	8
12	16 26	17 30	18 43	20 07	21 45	23 38	25 57	28 46	32 14	36 43	...	...	12
16	29 14	31 06	33 17	36 45	38 39	42 02	46 08	...	...	...	...	...	16
20	45 40	48 36	52 00	55 52	...	...	...	...	...	...	...	...	20
24	65 46	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	6.85	7.29	7.80	8.38	9.06	9.85	10.81	11.98	13.43	15.30	17.78	21.26	Δ_1h
Log.	0.835 69	0.862 73	0.892 09	0.923 24	0.957 13	0.993 44	1.033 83	1.078 46	1.128 08	1.184 69	1.249 93	1.327 56	Log.
Limit	19	18	17	16	15	14	13	12	11	10	9	8	Minutes
Meridian	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	...	5 23	4 28	3 48	4
8	...	...	...	...	...	...	...	...	...	21 34	17 52	15 13	8
12	...	...	...	...	...	...	...	...	...	...	40 11	34 14	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	...	...	...	...	...	...	...	...	...	20.22	16.74	14.26	Δ_1h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.305 78	1.223 76	1.154 12	Log.
Limit	7	6	4	2	0	2	4	6	8	9	10	11	Minutes
Meridian	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	Altitudes

Latitude 16° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 18	2 54	2 36	2 21	2 08	1 58	1 49	1 40	1 33	1 26	1 21	1 16	4
8	13 13	11 38	10 26	9 24	8 33	7 50	7 13	6 40	6 12	5 47	5 24	5 04	8
12	29 44	26 14	23 27	21 08	19 13	17 37	16 14	15 00	13 56	12 59	12 09	11 24	12
16	...	46 38	41 41	37 36	34 13	31 19	28 50	26 40	24 48	23 05	21 35	20 16	16
20	...	...	...	...	53 28	48 56	45 04	41 40	38 44	36 04	33 44	31 40	20
24	...	...	...	...	...	...	64 54	60 00	55 47	51 56	48 35	45 36	24
28	...	...	...	...	...	...	...	81 40	75 55	70 42	66 07	62 02	28
32	...	...	...	...	...	...	...	...	...	...	...	81 04	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	12.39	10.93	9.77	8.81	8.02	7.34	6.76	6.25	5.81	5.41	5.06	4.75	$\triangle_1 h$
Log.	1.093 07	1.038 62	0.989 89	0.944 98	0.904 17	0.865 70	0.829 95	0.795 88	0.764 18	0.733 20	0.704 15	0.676 69	Log.
Limit	12	13	14	15	16	17	19	21	22	23	24	26	Minutes
Meridian	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 11	1 07	1 03	1 00	0 57	0 54	0 51	0 49	0 46	0 44	0 42	0 40	4
8	4 46	4 30	4 14	4 00	3 47	3 36	3 25	3 15	3 05	2 56	2 47	2 40	8
12	10 43	10 06	9 32	9 00	8 31	8 05	7 41	7 18	6 56	6 36	6 17	6 00	12
16	19 01	17 58	16 56	16 00	15 09	14 23	13 39	12 58	12 20	11 44	11 11	10 40	16
20	29 44	28 04	26 28	25 00	23 40	22 28	21 20	20 16	19 16	18 20	17 28	16 40	20
24	42 48	40 25	38 06	36 00	34 05	32 21	30 43	29 11	27 45	26 24	25 10	24 00	24
28	58 17	55 01	51 53	49 00	46 23	44 02	41 49	39 43	37 46	35 56	34 14	32 40	28
32	76 07	71 51	67 46	64 00	60 35	57 31	54 37	51 53	49 19	46 56	44 42	42 40	32
36	...	...	...	...	76 41	72 48	69 07	65 40	62 26	59 24	56 36	54 00	36
40	...	...	...	...	...	89 52	85 20	81 04	77 04	73 20	69 52	66 40	40
44	...	...	...	...	...	...	...	...	...	88 44	84 33	80 40	44
48	...	...	...	...	...	...	...	...	...	...	...	96 00	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.46	4.21	3.97	3.75	3.55	3.37	3.20	3.04	2.89	2.75	2.62	2.50	$\triangle_1 h$
Log.	0.649 33	0.624 28	0.598 79	0.574 03	0.550 23	0.527 63	0.505 15	0.482 87	0.460 90	0.439 33	0.418 30	0.397 94	Log.
Limit	28	29	30	31	32	33	34	35	36	37	38	39	Minutes
Meridian	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	Altitudes

Latitude 16° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 36	0 35	0 33	0 31	0 30	0 29	0 27	0 27	0 25	0 23	0 22	4
8	2 33	2 26	2 19	2 13	2 06	2 01	1 55	1 50	1 45	1 41	1 36	1 32	8
12	5 43	5 27	5 12	4 58	4 46	4 32	4 19	4 08	3 56	3 46	3 35	3 24	12
16	10 09	9 41	9 16	8 50	8 26	8 04	7 41	7 20	7 00	6 42	6 21	6 06	16
20	15 52	15 08	14 28	13 48	13 12	12 36	12 00	11 28	10 56	10 28	9 56	9 32	20
24	22 51	21 47	20 50	19 52	19 00	18 09	17 17	16 31	15 45	15 04	14 18	13 43	24
28	31 06	29 40	28 21	27 03	25 53	24 42	23 31	22 29	21 25	20 31	19 29	18 42	28
32	40 37	38 45	37 02	35 20	33 48	32 15	30 43	29 21	27 59	26 48	25 26	24 25	32
36	51 25	49 02	46 53	44 43	42 46	40 50	38 53	37 09	35 26	33 55	32 11	30 53	36
40	63 28	60 32	57 52	55 12	52 48	50 24	48 00	45 52	43 44	41 52	39 44	38 08	40
44	76 48	73 15	70 02	66 48	63 53	60 59	58 05	55 30	52 55	50 40	48 04	46 08	44
48	91 23	87 10	83 19	79 29	76 02	72 34	69 07	66 01	62 58	60 17	57 13	54 55	48
52	107 15	102 18	97 47	93 17	89 14	85 10	81 07	77 31	73 54	70 45	67 09	64 27	52
56	. . .	. . .	. . .	108 12	103 29	98 17	94 05	89 54	85 43	82 04	77 52	74 44	56
60	. . .	. . .	. . .	. . .	. . .	113 24	108 00	103 12	98 24	94 12	89 24	85 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.38	2.27	2.17	2.07	1.98	1.89	1.80	1.72	1.64	1.57	1.49	1.43	△₁h
Log.	0.376 58	0.356 03	0.336 46	0.315 97	0.296 67	0.276 46	0.255 27	0.235 53	0.214 84	0.195 90	0.173 19	0.155 34	Log.
Limit	40	41	42	44	45	46	47	49	50	52	54	56	Minutes
Meridian	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 20	0 19	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 13	0 12	4
8	1 27	1 23	1 19	1 15	1 11	1 07	1 04	1 01	0 57	0 54	0 51	0 48	8
12	3 16	3 06	2 57	2 48	2 39	2 31	2 24	2 17	2 10	2 02	1 55	1 48	12
16	5 48	5 30	5 15	5 00	4 45	4 29	4 16	4 03	3 50	3 38	3 25	3 12	16
20	9 04	8 36	8 12	7 48	7 24	7 00	6 40	6 20	6 00	5 40	5 20	5 00	20
24	13 04	12 23	11 48	11 14	10 40	10 05	9 36	9 07	8 38	8 10	7 41	7 12	24
28	17 46	16 52	16 05	15 17	14 30	13 43	13 04	12 25	11 46	11 06	10 27	9 48	28
32	23 12	22 01	21 00	19 58	18 56	17 55	17 04	16 13	15 22	14 30	13 39	12 48	32
36	29 23	27 52	26 34	25 17	23 59	22 41	21 36	20 31	19 26	18 22	17 17	16 12	36
40	36 16	34 24	32 48	31 12	29 36	28 00	26 40	25 20	24 00	22 40	21 20	20 00	40
44	43 53	41 37	39 41	37 46	35 49	33 53	32 16	30 39	29 02	27 26	25 49	24 12	44
48	52 13	49 32	47 14	44 55	42 37	40 19	38 24	36 29	34 34	32 28	30 43	28 46	48
52	61 17	58 08	55 26	52 43	50 01	47 19	45 04	42 49	40 34	38 18	36 03	33 48	52
56	71 05	67 25	64 17	61 10	58 01	54 53	52 16	49 39	47 02	44 26	41 49	39 12	56
60	81 36	77 24	73 48	70 12	66 36	63 00	60 00	57 00	54 00	51 00	48 00	45 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.36	1.29	1.23	1.17	1.11	1.05	1.00	0.95	0.90	0.85	0.80	0.75	△₁h
Log.	0.133 54	0.110 59	0.089 91	0.068 19	0.045 32	0.021 19	0.00 . . .	9.977 72	9.954 24	9.929 42	9.903 09	9.875 06	Log.
Limit	57	59	61	63	65	66	68	70	72	74	76	78	Minutes
Meridian	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 50	1 43	1 38	1 32	1 28	1 24	1 20	1 16	1 14	1 10	1 08	1 05	4
8	7 18	6 53	6 30	6 11	5 53	5 36	5 21	5 07	4 54	4 43	4 32	4 21	8
12	16 26	15 29	14 38	13 54	13 13	12 36	12 01	11 30	11 02	10 35	10 11	9 48	12
16	29 14	27 31	26 02	24 42	23 31	22 24	21 23	20 26	19 38	18 49	18 05	17 24	16
20	45 40	43 00	40 40	38 36	36 44	35 00	33 24	31 56	30 40	29 24	28 16	27 12	20
24	65 46	61 55	58 34	55 35	52 54	50 24	48 06	45 59	44 10	42 20	40 42	39 10	24
28	...	84 17	79 42	75 40	72 00	68 36	65 28	62 34	60 06	57 38	55 24	53 19	28
32	...	...	...	...	...	...	...	81 45	78 30	75 16	72 22	69 38	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	6.85	6.45	6.10	5.79	5.51	5.25	5.01	4.79	4.60	4.41	4.24	4.08	$\triangle_1$h
Log.	0.835 69	0.809 56	0.785 33	0.762 68	0.741 15	0.720 16	0.699 84	0.680 34	0.662 76	0.644 44	0.627 37	0.610 66	Log.
Limit	20	21	22	23	24	24	25	26	27	28	29	29	Minutes
Meridian	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 02	1 00	0 59	0 57	0 54	0 53	0 51	0 50	0 48	0 46	0 46	0 44	4
8	4 11	4 03	3 54	3 47	3 39	3 32	3 26	3 19	3 13	3 07	3 02	2 57	8
12	9 26	9 06	8 47	8 30	8 13	7 56	7 42	7 27	7 15	7 02	6 49	6 38	12
16	16 46	16 10	15 37	15 06	14 35	14 08	13 42	13 17	12 53	12 30	12 07	11 46	16
20	26 12	25 16	24 24	23 36	22 48	22 04	21 24	20 44	20 08	19 32	18 56	18 24	20
24	37 43	36 23	35 09	33 59	32 50	31 47	30 49	29 52	29 00	28 07	27 16	26 30	24
28	51 22	49 32	47 49	46 15	44 42	43 15	41 57	40 38	39 28	38 18	37 06	36 04	28
32	67 05	64 41	62 27	60 25	58 22	56 29	54 47	53 04	51 32	50 01	48 28	47 06	32
36	...	...	79 04	76 28	73 52	71 30	69 20	67 11	65 14	63 17	61 21	59 37	36
40	...	...	...	...	91 12	88 16	85 36	82 56	80 32	78 08	75 44	73 36	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.93	3.79	3.66	3.54	3.42	3.31	3.21	3.11	3.02	2.93	2.84	2.76	$\triangle_1$h
Log.	0.594 39	0.578 64	0.563 48	0.549 00	0.534 03	0.519 83	0.506 51	0.492 76	0.480 01	0.466 87	0.453 32	0.440 91	Log.
Limit	30	30	31	32	33	34	35	36	36	37	38	39	Minutes
Meridian	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	Altitudes

Latitude 16° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 42	0 41	0 39	0 38	0 37	0 36	0 35	0 35	0 34	0 33	0 31	4
8	2 51	2 47	2 43	2 39	2 34	2 29	2 26	2 22	2 17	2 14	2 11	2 07	8
12	6 26	6 15	6 06	5 56	5 46	5 35	5 27	5 18	5 09	5 02	4 54	4 47	12
16	11 26	11 09	10 50	10 32	10 14	9 57	9 41	9 26	9 11	8 58	8 42	8 29	16
20	17 52	17 24	16 56	16 28	16 00	15 32	15 08	14 44	14 20	14 00	13 36	13 16	20
24	25 44	25 04	24 23	23 42	23 02	22 22	21 47	21 13	20 39	20 10	19 35	19 06	24
28	35 01	34 06	33 11	32 17	31 22	30 27	29 40	28 53	28 05	27 26	26 39	26 01	28
32	45 44	44 32	43 21	42 10	40 58	39 46	38 45	37 43	36 41	35 50	34 49	33 58	32
36	57 54	56 23	54 52	53 21	51 50	50 20	49 02	47 44	46 27	45 22	44 04	42 59	36
40	71 28	69 36	67 44	65 52	64 00	62 08	60 32	58 56	57 20	56 00	54 24	53 04	40
44	86 29	84 13	81 57	79 42	77 26	75 11	73 15	71 18	69 23	67 46	65 49	64 12	44
48	...	...	...	94 51	92 10	89 28	87 10	84 52	82 33	80 38	78 20	76 25	48
52	...	...	...	...	108 10	105 00	102 18	99 36	96 53	94 38	91 56	89 41	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.68	2.61	2.54	2.47	2.40	2.33	2.27	2.21	2.15	2.10	2.04	1.99	$\Delta_1 h$
Log.	0.428 13	0.416 64	0.404 83	0.392 70	0.380 21	0.367 36	0.356 03	0.344 39	0.332 44	0.322 22	0.309 63	0.298 85	Log.
Limit	40	41	42	43	44	45	46	46	47	48	49	50	Minutes
Meridian	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 30	0 30	0 28	0 28	0 27	0 27	0 26	0 25	0 24	0 23	0 22	4
8	2 04	2 01	1 58	1 55	1 52	1 48	1 45	1 42	1 41	1 38	1 35	1 33	8
12	4 40	4 32	4 25	4 18	4 11	4 03	3 57	3 51	3 46	3 40	3 34	3 28	12
16	8 16	8 04	7 51	7 38	7 25	7 13	7 03	6 53	6 42	6 32	6 18	6 08	16
20	12 56	12 36	12 16	11 56	11 36	11 16	11 00	10 44	10 28	10 12	9 52	9 36	20
24	18 37	18 09	17 40	17 11	16 42	16 14	15 51	15 28	15 04	14 41	14 12	13 49	24
28	25 21	24 42	24 02	23 24	22 44	22 05	21 33	21 02	20 31	20 00	19 21	18 49	28
32	33 07	32 15	31 24	30 33	29 42	28 50	28 09	27 28	26 48	26 07	25 16	24 35	32
36	41 54	40 50	39 45	38 40	37 35	36 31	35 39	34 47	33 55	33 03	31 58	31 06	36
40	51 44	50 24	49 04	47 44	46 24	45 04	44 00	42 56	41 52	40 48	39 28	38 24	40
44	62 35	60 59	59 22	57 45	56 08	54 32	53 15	51 57	50 40	49 22	47 45	46 27	44
48	74 30	72 34	70 39	68 42	66 47	64 53	63 21	61 49	60 17	58 45	56 50	55 18	48
52	87 26	85 10	82 55	80 40	78 25	76 09	74 21	72 33	70 45	68 57	66 42	64 54	52
56	101 23	98 47	96 10	93 33	90 56	88 20	86 15	84 09	82 04	79 58	77 21	75 15	56
60	...	113 24	110 24	107 24	104 24	101 24	99 00	96 36	94 12	91 48	88 48	86 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.94	1.89	1.84	1.79	1.74	1.69	1.65	1.61	1.57	1.53	1.48	1.44	$\Delta_1 h$
Log.	0.287 80	0.276 46	0.264 82	0.252 85	0.240 55	0.227 89	0.217 48	0.206 83	0.195 90	0.184 69	0.170 26	0.158 36	Log.
Limit	50	51	52	53	54	54	55	56	57	58	59	60	Minutes
Meridian	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	Altitudes

Latitude 16° Declination Contrary Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 21	0 20	0 20	0 19	0 19	0 19	0 18	0 17	0 17	0 16	4
8	1 30	1 28	1 25	1 23	1 20	1 18	1 15	1 13	1 11	1 08	1 07	1 04	8
12	3 23	3 17	3 11	3 06	3 00	2 56	2 50	2 44	2 39	2 34	2 30	2 25	12
16	6 01	5 51	5 41	5 30	5 20	5 12	5 02	4 52	4 45	4 34	4 26	4 19	16
20	9 24	9 08	8 52	8 36	8 20	8 08	7 52	7 36	7 24	7 08	6 56	6 44	20
24	13 32	13 09	12 46	12 23	12 00	11 43	11 20	10 57	10 40	10 16	9 59	9 42	24
28	18 26	17 54	17 23	16 52	16 20	15 57	15 25	14 53	14 30	13 59	13 35	13 12	28
32	24 04	23 23	22 42	22 01	21 20	20 49	20 08	19 27	18 56	18 16	17 45	17 14	32
36	30 27	29 36	28 44	27 52	27 00	26 21	25 30	24 38	23 59	23 07	22 28	21 49	36
40	37 36	36 32	35 28	34 24	33 20	32 32	31 28	30 24	29 36	28 32	27 44	26 56	40
44	45 29	44 13	42 55	41 37	40 20	39 22	38 05	36 47	35 49	34 32	33 33	32 35	44
48	54 09	52 36	51 04	49 32	48 00	46 51	45 18	43 46	42 37	41 05	39 56	38 47	48
52	63 33	61 44	59 56	58 08	56 20	54 29	53 10	51 22	50 01	48 13	46 52	45 31	52
56	73 41	71 37	69 31	67 25	65 20	63 46	61 41	59 35	58 01	55 56	54 21	52 47	56
60	84 36	82 12	79 48	77 24	75 00	73 12	70 48	68 24	66 36	64 12	62 24	60 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.41	1.37	1.33	1.29	1.25	1.22	1.18	1.14	1.11	1.07	1.04	1.01	$\triangle_1$h
Log.	0.149 22	0.136 72	0.123 85	0.110 59	0.096 91	0.086 36	0.071 88	0.056 90	0.045 32	0.029 38	0.017 03	0.004 32	Log.
Limit	61	63	64	66	67	69	71	73	74	75	76	77	Minutes
Meridian	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 15	0 14	0 14	0 14	0 13	0 12	0 12	0 11	0 11	0 11	...	4
8	1 02	1 00	0 58	0 55	0 54	0 51	0 50	0 47	0 45	0 43	0 41	...	8
12	2 20	2 16	2 11	2 05	2 01	1 55	1 51	1 47	1 42	1 37	1 33	...	12
16	4 08	4 00	3 53	3 43	3 35	3 25	3 17	3 09	3 02	2 54	2 47	...	16
20	6 28	6 16	6 04	5 48	5 36	5 20	5 08	4 56	4 44	4 32	4 20	...	20
24	9 18	9 01	8 44	8 21	8 04	7 41	7 23	7 06	6 49	6 32	6 15	...	24
28	12 41	12 17	11 54	11 22	10 58	10 27	10 04	9 40	9 17	8 53	8 29	...	28
32	16 34	16 03	15 32	14 51	14 20	13 39	13 09	12 38	12 07	11 36	11 05	...	32
36	20 57	20 18	19 39	18 48	18 09	17 17	16 38	15 59	15 20	14 42	14 03	...	36
40	25 52	25 04	24 16	23 12	22 24	21 20	20 32	19 44	18 56	18 08	17 20	...	40
44	31 18	30 19	29 21	28 05	27 06	25 49	24 51	23 52	22 54	21 57	20 59	...	44
48	37 15	36 06	34 57	33 24	32 15	30 43	29 32	28 23	27 14	26 06	24 57	...	48
52	43 43	42 22	41 01	39 12	37 51	36 03	34 42	33 21	32 00	30 38	29 17	...	52
56	50 42	49 07	47 33	45 29	43 54	41 49	40 15	38 40	37 06	35 33	33 59	...	56
60	58 12	56 24	54 36	52 12	50 24	48 00	46 12	44 24	42 36	40 48	39 00	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.97	0.94	0.91	0.87	0.84	0.80	0.77	0.74	0.71	0.68	0.65	...	$\triangle_1$h
Log.	9.986 77	9.973 13	9.959 04	9.939 52	9.924 28	9.903 09	9.886 49	9.869 23	9.851 26	9.832 51	9.812 91	... ...	Log.
Limit	78	79	80	81	82	83	84	85	86	87	88		Minutes
Meridian	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	Altitudes

Latitude 17° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 42	1 49	1 56	2 04	2 13	2 24	2 36	2 51	3 10	3 34	4 03	4 43	4
8	6 51	7 16	7 44	8 16	8 53	9 36	10 27	11 27	12 41	14 13	16 11	18 48	8
12	15 25	16 20	17 24	18 36	19 59	21 36	23 30	25 45	28 32	31 59	36 24	...	12
16	27 23	29 04	30 56	33 04	35 33	38 24	41 46	45 47	...	...	...	...	16
20	42 48	45 24	48 20	51 40	55 32	...	...	...	...	...	...	...	20
24	61 38	65 23	...	...	...	...	...	...	...	...	...	...	24
28	83 54	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	6.42	6.81	7.25	7.75	8.33	9.00	9.79	10.73	11.89	13.33	15.17	17.63	$\Delta_1 h$
Log.	0.807 54	0.833 15	0.860 34	0.889 30	0.920 65	0.954 24	0.990 78	1.030 60	1.075 18	1.124 83	1.180 99	1.246 25	Log.
Limit	21	20	19	18	17	16	15	14	13	12	10	8	Minutes
Meridian	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	5 37	...	...	...	...	...	...	...	...	...	5 19	4 25	4
8	22 29	...	...	...	...	...	...	...	...	...	21 18	17 39	8
12	...	...	...	...	...	...	...	...	...	...	...	39 42	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	21.07	...	...	...	...	...	...	...	...	...	19.98	16.54	$\Delta_1 h$
Log.	1.323 66	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.300 60	1.218 54	Log.
Limit	7	6	5	3	2	0	1	3	5	7	8	9	Minutes
Meridian	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	Altitudes

Latitude 17° Declination Same Name.

Declinations.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 45	3 16	2 52	2 34	2 19	2 06	1 55	1 47	1 39	1 31	1 25	1 19	4
8	15 01	13 03	11 31	10 16	9 16	8 25	7 43	7 05	6 33	6 06	5 40	5 18	8
12	33 48	29 21	25 54	23 06	20 51	18 58	17 21	15 57	14 45	13 42	12 46	11 58	12
16	...	...	46 02	41 06	37 05	33 42	30 51	28 23	26 15	24 22	22 42	21 14	16
20	...	...	...	...	57 56	52 40	48 12	44 20	41 00	38 04	35 28	33 12	20
24	...	...	...	...	...	...	...	63 51	59 03	54 49	51 05	47 48	24
28	...	...	...	...	...	...	...	...	80 21	74 37	69 31	65 03	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	14.08	12.23	10.79	9.63	8.69	7.90	7.23	6.65	6.15	5.71	5.32	4.98	$\triangle_1 h$
Log.	1.148 60	1.087 43	1.033 02	0.983 63	0.939 02	0.897 63	0.859 14	0.822 82	0.788 88	0.756 64	0.725 91	0.697 23	Log.
Limit	10	12	13	14	15	16	18	19	20	21	23	25	Minutes
Meridian	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	Altitudes

Declinations.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 15	1 10	1 06	1 02	0 59	0 55	0 53	0 50	0 47	0 45	0 43	0 41	4
8	4 59	4 40	4 24	4 09	3 55	3 43	3 31	3 20	3 10	3 01	2 52	2 44	8
12	11 12	10 31	9 54	9 22	8 50	8 22	7 55	7 30	7 10	6 47	6 27	6 09	12
16	19 56	18 41	17 38	16 38	15 42	14 50	14 05	13 22	12 42	12 05	11 29	10 55	16
20	31 08	29 12	27 32	26 00	24 32	23 12	22 00	20 52	19 52	18 52	17 56	17 04	20
24	44 50	42 03	39 39	37 26	35 20	33 24	31 41	30 03	28 36	27 10	25 50	24 35	24
28	61 01	57 14	53 58	50 58	48 05	45 29	43 07	40 54	38 57	36 59	35 09	33 27	28
32	79 42	74 45	70 29	66 34	62 48	59 24	56 19	53 25	50 52	48 18	45 54	43 41	32
36	...	...	...	...	79 30	75 10	71 17	67 37	64 22	61 08	58 07	55 18	36
40	...	...	...	...	...	...	88 00	83 28	79 28	75 28	71 44	68 16	40
44	...	...	...	...	...	...	...	...	...	...	86 48	82 36	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.67	4.38	4.13	3.90	3.68	3.48	3.30	3.13	2.98	2.83	2 69	2.56	$\triangle_1 h$
Log.	0.669 32	0.641 47	0.615 95	0.591 06	0.565 85	0.541 58	0.518 51	0.495 54	0.474 22	0.451 79	0.429 75	0.408 24	Log.
Limit	27	28	29	30	31	32	33	34	35	36	37	38	Minutes
Meridian	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	Altitudes

Latitude 17° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 39	0 37	0 35	0 34	0 32	0 30	0 29	0 28	0 27	0 25	0 24	0 23	4
8	2 37	2 28	2 22	2 15	2 09	2 02	1 57	1 52	1 47	1 42	1 37	1 33	8
12	5 52	5 34	5 20	5 03	4 51	4 37	4 23	4 12	4 00	3 49	3 39	3 29	12
16	10 24	9 54	9 28	9 01	8 37	8 11	7 49	7 28	7 08	6 47	6 29	6 11	16
20	16 16	15 28	14 48	14 04	13 28	12 48	12 12	11 40	11 08	10 36	10 08	9 40	20
24	23 25	22 17	21 19	20 16	19 24	18 26	17 34	16 48	16 02	15 16	14 36	13 55	24
28	31 53	30 19	29 01	27 34	26 24	25 06	23 55	22 52	21 49	20 47	19 52	18 57	28
32	41 39	39 35	37 53	36 00	34 28	32 46	31 13	29 52	28 30	27 08	25 56	24 45	32
36	52 42	50 07	47 57	45 35	43 38	41 28	39 32	37 48	36 05	34 21	32 50	31 19	36
40	65 04	61 52	59 12	56 16	53 52	51 12	48 48	46 40	44 32	42 24	40 32	38 40	40
44	78 43	74 52	71 38	68 05	65 11	61 57	59 03	56 28	53 54	51 18	49 03	46 47	44
48	93 42	89 05	85 15	81 01	77 34	73 44	70 16	67 10	64 07	61 03	58 22	55 41	48
52	...	104 33	100 03	95 05	91 02	86 32	82 28	78 52	75 15	71 39	68 30	65 21	52
56	...	...	...	...	105 35	100 21	95 39	91 28	87 18	83 06	79 27	75 37	56
60	...	...	...	...	...	...	109 48	105 00	100 12	95 24	91 12	87 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.44	2.32	2.22	2.11	2.02	1.92	1.83	1.75	1.67	1.59	1.52	1.45	$\Delta_1 h$
Log.	0.387 39	0.365 49	0.346 35	0.324 28	0.305 35	0.283 30	0.262 45	0.243 04	0.222 72	0.201 40	0.181 84	0.161 37	Log.
Limit	39	40	41	43	44	45	46	48	49	51	53	55	Minutes
Meridian	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 21	0 20	0 19	0 18	0 17	0 16	0 15	0 14	0 14	0 13	0 12	4
8	1 28	1 23	1 20	1 16	1 11	1 08	1 04	1 01	0 58	0 54	0 51	0 48	8
12	3 19	3 08	3 00	2 51	2 41	2 33	2 25	2 19	2 11	2 02	1 55	1 48	12
16	5 53	5 36	5 20	5 05	4 47	4 31	4 19	4 05	3 53	3 38	3 25	3 12	16
20	9 12	8 44	8 20	7 56	7 28	7 04	6 44	6 24	6 04	5 40	5 20	5 00	20
24	13 15	12 35	12 00	11 26	10 46	10 11	9 42	9 13	8 44	8 10	7 41	7 12	24
28	18 02	17 07	16 20	15 33	14 38	13 51	13 12	12 33	11 54	11 06	10 27	9 48	28
32	23 33	22 21	21 20	20 18	19 06	18 05	17 14	16 23	15 32	14 30	13 39	12 48	32
36	29 49	28 18	27 00	25 43	24 12	22 54	21 49	20 44	19 39	18 22	17 17	16 12	36
40	36 48	34 56	33 20	31 44	29 52	28 16	26 56	25 36	24 16	22 40	21 20	20 00	40
44	44 32	42 16	40 20	38 24	36 09	34 12	32 35	30 58	29 21	27 26	25 49	24 12	44
48	52 59	50 18	48 00	45 41	43 00	40 42	38 47	36 52	34 57	32 38	30 43	28 46	48
52	62 11	59 02	56 20	53 37	50 28	47 46	45 31	43 16	41 01	38 18	36 03	33 48	52
56	72 08	68 28	65 20	62 12	58 33	55 24	52 47	50 10	47 33	44 26	41 49	39 12	56
60	82 48	78 36	75 00	71 24	67 12	63 36	60 36	57 36	54 36	51 00	48 00	45 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.38	1.31	1.25	1.19	1.12	1.06	1.01	0.96	0.91	0.85	0.80	0.75	$\Delta_1 h$
Log.	0.139 88	0.117 27	0.096 91	0.075 55	0.049 22	0.025 31	0.004 32	9.982 27	9.959 04	9.929 42	9.903 09	9.875 06	Log.
Limit	56	58	60	62	64	66	67	69	71	73	75	77	Minutes
Meridian	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 42	1 37	1 32	1 27	1 23	1 19	1 16	1 13	1 10	1 07	1 05	1 02	4
8	6 51	6 29	6 09	5 51	5 35	5 19	5 06	4 53	4 42	4 31	4 21	4 11	8
12	15 25	14 36	13 50	13 10	12 33	11 59	11 29	11 00	10 34	10 09	9 46	9 26	12
16	27 23	25 56	24 34	23 22	22 19	21 17	20 23	19 32	18 46	18 03	17 22	16 46	16
20	42 48	40 32	38 24	36 32	34 52	33 16	31 52	30 32	29 20	28 12	27 08	26 12	20
24	61 38	58 22	55 18	52 36	50 12	47 54	45 53	43 58	42 14	40 36	39 04	37 43	24
28	83 54	79 27	75 16	71 37	68 21	65 11	62 26	59 51	57 30	55 17	53 11	51 22	28
32	...	...	...	...	...	...	81 35	78 10	75 06	72 12	69 28	67 05	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.42	6.08	5.76	5.48	5.23	4.99	4.78	4.58	4.40	4.23	4.07	3.93	$\triangle_1 h$
Log.	0.807 54	0.783 90	0.760 42	0.738 78	0.718 50	0.698 10	0.679 43	0.660 87	0.643 45	0.626 34	0.609 59	0.594 39	Log.
Limit	21	22	23	24	25	25	26	27	28	29	30	31	Minutes
Meridian	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 00	0 59	0 57	0 54	0 53	0 51	0 50	0 48	0 46	0 46	0 44	0 43	4
8	4 03	3 54	3 47	3 39	3 32	3 26	3 19	3 13	3 07	3 02	2 58	2 52	8
12	9 06	8 47	8 30	8 13	7 56	7 42	7 27	7 15	7 02	6 50	6 39	6 27	12
16	16 10	15 37	15 06	14 35	14 08	13 42	13 17	12 53	12 30	12 10	11 49	11 29	16
20	25 16	24 24	23 36	22 48	22 04	21 24	20 44	20 08	19 32	19 00	18 28	17 56	20
24	36 23	35 09	33 59	32 50	31 47	30 49	29 52	29 00	28 07	27 22	26 35	25 50	24
28	49 32	47 49	46 15	44 42	43 15	41 57	40 38	39 28	38 18	37 14	36 12	35 09	28
32	64 41	62 27	60 25	58 22	56 29	54 47	53 04	51 32	50 01	48 38	47 17	45 54	32
36	...	79 04	76 28	73 52	71 30	69 20	67 11	65 14	63 17	61 34	59 50	58 07	36
40	...	...	...	91 12	88 16	85 36	82 56	80 32	78 08	76 00	73 52	71 44	40
44	...	...	...	...	...	...	...	...	...	...	...	86 48	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.79	3.66	3.54	3.42	3.31	3.21	3.11	3.02	2.93	2.85	2.77	2.69	$\triangle_1 h$
Log.	0.578 64	0 563 48	0.549 00	0.534 03	0.519 83	0.506 51	0.492 76	0.480 01	0.466 87	0.454 84	0.442 48	0.429 75	Log.
Limit	32	32	33	33	34	35	35	36	37	38	39	40	Minutes
Meridian	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	Altitudes

Latitude 17° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 42	0 41	0 39	0 38	0 38	0 36	0 35	0 35	0 34	0 33	0 32	0 31	4
8	2 47	2 43	2 39	2 35	2 30	2 26	2 22	2 19	2 15	2 12	2 08	2 04	8
12	6 15	6 06	5 56	5 47	5 37	5 29	5 20	5 12	5 03	4 57	4 48	4 41	12
16	11 09	10 50	10 32	10 17	9 59	9 43	9 28	9 16	9 01	8 47	8 32	8 19	16
20	17 24	16 56	16 28	16 04	15 36	15 12	14 48	14 28	14 04	13 44	13 20	13 00	20
24	25 04	24 23	23 42	23 08	22 28	21 53	21 19	20 50	20 16	19 47	19 12	18 43	24
28	34 06	33 11	32 17	31 30	30 34	29 48	29 01	28 51	27 34	26 55	26 08	25 29	28
32	44 32	43 21	42 10	41 08	39 56	38 55	37 53	37 02	36 00	35 09	34 08	33 17	32
36	56 23	54 52	53 21	52 03	50 33	49 15	47 57	46 53	45 35	44 30	43 12	42 07	36
40	69 36	67 44	65 52	64 16	62 24	60 48	59 12	57 52	56 16	54 56	53 20	52 00	40
44	84 13	81 57	79 42	77 45	75 30	73 34	71 38	70 02	68 05	66 28	64 32	62 55	44
48	...	...	94 51	92 33	89 51	87 33	85 15	83 19	81 01	79 06	76 48	74 53	48
52	...	...	...	...	105 27	102 45	100 03	97 47	95 05	92 50	90 08	87 53	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.61	2.54	2.47	2.41	2.34	2.28	2.22	2.17	2.11	2.06	2.00	1.95	△₁h
Log.	0.416 64	0.404 83	0.392 70	0.382 02	0.369 22	0.357 93	0.346 35	0.336 46	0.324 28	0.313 87	0.301 03	0.290 03	Log.
Limit	41	42	43	44	45	46	46	47	48	49	50	50	Minutes
Meridian	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 30	0 29	0 28	0 27	0 27	0 26	0 25	0 25	0 24	0 23	0 22	4
8	2 01	1 58	1 56	1 53	1 50	1 47	1 44	1 41	1 39	1 36	1 34	1 31	8
12	4 34	4 26	4 20	4 14	4 06	4 00	3 54	3 48	3 42	3 36	3 31	3 25	12
16	8 06	7 54	7 44	7 30	7 18	7 08	6 58	6 44	6 34	6 24	6 13	6 03	16
20	12 40	12 20	12 04	11 44	11 24	11 08	10 52	10 32	10 16	10 00	9 44	9 28	20
24	18 14	17 46	17 23	16 54	16 25	16 02	15 39	15 10	14 47	14 24	14 01	13 38	24
28	24 50	24 10	23 39	23 00	22 21	21 49	21 18	20 39	20 07	19 36	19 05	18 34	28
32	32 26	31 34	30 53	30 02	29 11	28 30	27 49	26 58	26 17	25 36	24 55	24 14	32
36	41 02	39 58	39 06	38 01	36 56	36 05	35 13	34 08	33 16	32 24	31 32	30 40	36
40	50 40	49 20	48 16	46 56	45 36	44 32	43 28	42 08	41 04	40 00	38 56	37 52	40
44	61 18	59 42	58 24	56 47	55 10	53 54	52 36	50 59	49 41	48 24	47 06	45 49	44
48	72 58	71 02	69 30	67 33	65 38	64 07	62 35	60 40	59 08	57 36	56 04	54 32	48
52	85 38	83 22	81 34	79 19	77 04	75 15	73 27	71 12	69 24	67 36	65 48	64 00	52
56	99 18	96 42	94 36	91 59	89 22	87 18	85 12	82 35	80 29	78 24	76 18	74 13	56
60	114 00	111 00	108 36	105 36	102 36	100 12	97 48	94 48	92 24	90 00	87 36	85 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.90	1.85	1.81	1.76	1.71	1.67	1.63	1.58	1.54	1.50	1.46	1.42	△₁h
Log.	0.278 75	0.267 17	0.257 68	0.245 51	0.233 00	0.222 72	0.212 19	0.198 66	0.187 52	0.176 09	0.164 35	0.152 29	Log.
Limit	50	51	52	53	54	55	56	57	58	59	60	61	Minutes
Meridian	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 21	0 20	0 20	0 19	0 19	0 18	0 18	0 17	0 16	0 16	4
8	1 29	1 26	1 23	1 21	1 20	1 17	1 15	1 12	1 10	1 08	1 06	1 04	8
12	3 20	3 14	3 08	3 03	2 59	2 53	2 48	2 42	2 38	2 33	2 28	2 24	12
16	5 56	5 46	5 36	5 25	5 17	5 07	5 00	4 50	4 42	4 31	4 24	4 16	16
20	9 16	9 00	8 44	8 28	8 16	8 00	7 48	7 32	7 20	7 04	6 52	6 40	20
24	13 21	12 58	12 35	12 11	11 54	11 31	11 14	10 51	10 34	10 11	9 53	9 36	24
28	18 10	17 38	17 07	16 36	16 12	15 41	15 17	14 46	14 22	13 51	13 28	13 04	28
32	23 43	23 02	22 21	21 41	21 10	20 29	19 58	19 17	18 46	18 05	17 35	17 04	32
36	30 02	29 10	28 18	27 26	26 47	25 55	25 17	24 25	23 46	22 54	22 15	21 36	36
40	37 04	36 00	34 56	33 52	33 04	32 00	31 12	30 08	29 20	28 16	27 28	26 40	40
44	44 51	43 34	42 16	40 59	40 00	38 43	37 46	36 28	35 30	34 12	33 14	32 16	44
48	53 22	51 50	50 18	48 46	47 37	46 05	44 55	43 23	42 14	40 42	39 33	38 24	48
52	62 38	60 50	59 02	57 14	55 53	54 05	52 43	50 55	49 34	47 46	46 25	45 04	52
56	72 39	70 34	68 28	66 23	64 48	62 43	61 10	59 04	57 30	55 24	53 50	52 16	56
60	83 24	81 00	78 36	76 12	74 24	72 00	70 12	67 48	66 00	63 36	61 48	60 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.39	1.35	1.31	1.27	1.24	1.20	1.17	1.13	1.10	1.06	1.03	1.00	$\Delta_1 h$
Log.	0.143 01	0.130 33	0.117 27	0.103 80	0.093 42	0.079 18	0.068 19	0.053 08	0.041 39	0.025 31	0.012 84	0.00 ...	Log.
Limit	62	64	65	67	68	69	71	74	75	76	77	78	Minutes
Meridian	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 14	0 14	0 14	0 13	0 13	0 12	0 11	0 11	0 11	...	...	4
8	1 01	0 59	0 57	0 55	0 53	0 51	0 50	0 47	0 45	0 42	...	...	8
12	2 19	2 14	2 10	2 05	1 59	1 55	1 51	1 45	1 41	1 36	...	...	12
16	4 05	3 58	3 50	3 43	3 33	3 25	3 17	3 07	2 59	2 52	...	...	16
20	6 24	6 12	6 00	5 48	5 32	5 20	5 08	4 52	4 40	4 28	...	...	20
24	9 13	8 55	8 38	8 21	7 58	7 41	7 23	7 00	6 43	6 26	...	...	24
28	12 33	12 10	11 46	11 22	10 51	10 27	10 04	9 33	9 09	8 45	...	...	28
32	16 23	15 53	15 22	14 51	14 10	13 39	13 09	12 28	11 57	11 26	...	...	32
36	20 44	20 05	19 26	18 48	17 56	17 17	16 38	15 46	15 07	14 29	...	...	36
40	25 36	24 48	24 00	23 12	22 08	21 20	20 32	19 28	18 40	17 52	...	...	40
44	30 58	30 00	29 02	28 05	26 47	25 49	24 51	23 33	22 35	21 38	...	...	44
48	36 52	35 43	34 34	33 24	31 52	30 43	29 32	28 00	26 51	25 43	...	...	48
52	43 16	41 55	40 34	39 12	37 24	36 03	34 42	32 54	31 33	30 11	...	...	52
56	50 10	48 36	47 02	45 29	43 23	41 49	40 15	38 09	36 35	35 02	...	...	56
60	57 36	55 48	54 00	52 12	49 48	48 00	46 12	43 48	42 00	40 12	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.96	0.93	0.90	0.87	0.83	0.80	0.77	0.73	0.70	0.67	...	...	$\Delta_1 h$
Log.	9.982 27	9.968 48	9.954 24	9.939 52	9.919 08	9.903 09	9.886 49	9.863 32	9.845 10	9.826 07	... ...	... ...	Log.
Limit	79	80	81	82	84	85	86	87	88	89	90	91	Minutes
Meridian	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	Altitudes

Latitude 18° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 37	1 42	1 49	1 55	2 03	2 12	2 22	2 35	2 51	3 08	3 31	4 01	4
8	6 27	6 49	7 14	7 42	8 13	8 50	9 31	10 22	11 21	12 35	14 06	16 03	8
12	14 30	15 20	16 15	17 18	18 29	19 51	21 26	23 18	25 33	28 18	31 42	36 06	12
16	25 46	27 16	28 53	30 46	32 51	35 17	38 06	41 26	45 27	...	...	...	16
20	40 16	42 36	45 08	48 04	51 20	55 08	...	...	...	...	...	...	20
24	57 59	61 21	64 59	...	...	...	...	...	...	...	...	...	24
28	78 55	83 31	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.04	6.39	6.77	7.21	7.70	8.27	8.93	9.71	10.65	11.79	13.21	15.04	$\triangle_1 h$
Log.	0.781 04	0.805 50	0.830 59	0.857 94	0.886 49	0.917 51	0.950 85	0.987 22	1.027 35	1.071 51	1.120 90	1.177 25	Log.
Limit	22	21	20	19	18	17	16	15	14	13	12	11	Minutes
Meridian	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	4 39	5 34	...	...	...	...	...	...	...	...	...	5 15	4
8	18 39	22 16	...	...	...	...	...	...	...	...	...	21 02	8
12	...	...	...	...	...	...	...	...	...	...	...	...	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	17.47	20.88	...	...	...	...	...	...	...	...	...	19.72	$\triangle_1 h$
Log.	1.242 29	1.319 73	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.294 91	Log.
Limit	10	9	7	5	3	1	0	1	4	6	7	8	Minutes
Meridian	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	Altitudes

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Latitude 18° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	4 21	3 42	3 13	2 51	2 32	2 17	2 04	1 54	1 45	1 37	1 30	1 23	4
8	17 24	14 49	12 52	11 21	10 08	9 08	8 18	7 35	6 59	6 27	5 59	5 35	8
12	39 10	33 20	28 57	25 32	22 48	20 33	18 41	17 05	15 43	14 31	13 27	12 33	12
16	...	...	...	45 24	40 32	36 31	33 11	30 23	27 57	25 49	23 57	22 19	16
20	...	...	...	...	...	57 04	51 52	47 28	43 40	40 20	37 24	34 52	20
24	...	...	...	...	...	...	...	...	62 53	58 05	53 52	50 12	24
28	...	...	...	...	...	...	...	...	...	79 03	73 18	68 21	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	16.32	13.89	12.06	10.64	9.50	8.56	7.78	7.12	6.55	6.05	5.61	5.23	$\Delta_1 h$
Log.	1.212 72	1.142 70	1.081 35	1.026 94	0.977 72	0.932 47	0.890 98	0.852 48	0.816 24	0.781 76	0.748 96	0.718 50	Log.
Limit	9	11	12	13	14	15	17	18	20	21	22	24	Minutes
Meridian	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 18	1 13	1 09	1 05	1 01	0 58	0 54	0 51	0 49	0 46	0 44	0 42	4
8	5 13	4 53	4 35	4 19	4 05	3 51	3 39	3 27	3 16	3 06	2 57	2 48	8
12	11 44	11 00	10 19	9 43	9 10	8 39	8 11	7 45	7 21	6 59	6 38	6 18	12
16	20 52	19 32	18 21	17 17	16 18	15 25	14 33	13 47	13 03	12 25	11 46	11 14	16
20	32 36	30 32	28 40	27 00	25 28	24 04	22 44	21 32	20 24	19 24	18 24	17 32	20
24	46 57	43 58	41 17	38 53	36 41	34 40	32 44	31 00	29 23	27 56	26 30	25 15	24
28	63 54	59 51	56 11	52 55	49 55	47 10	44 34	42 13	39 59	38 02	36 04	34 22	28
32	83 27	78 10	73 23	69 07	65 11	61 36	58 12	55 08	52 13	49 40	47 06	44 53	32
36	...	...	...	...	...	77 59	73 39	69 46	66 06	62 51	59 37	56 49	36
40	...	...	...	...	...	...	90 56	86 08	81 36	77 36	73 36	70 08	40
44	...	...	...	...	...	...	...	...	...	...	...	84 52	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	4.89	4.58	4.30	4.05	3.82	3.61	3.41	3.23	3.06	2.91	2.76	2.63	$\Delta_1 h$
Log.	0.689 31	0.660 87	0.633 47	0.607 46	0.582 06	0.557 51	0.532 75	0.509 20	0.485 72	0.463 89	0.440 91	0.419 96	Log.
Limit	26	27	28	29	30	31	32	33	34	36	37	38	Minutes
Meridian	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	Altitudes

Latitude 18° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 40	0 38	0 36	0 35	0 33	0 31	0 30	0 28	0 27	0 26	0 25	0 23	4
8	2 40	2 32	2 26	2 18	2 12	2 05	2 00	1 54	1 49	1 43	1 39	1 34	8
12	6 00	5 43	5 27	5 11	4 57	4 43	4 29	4 17	4 05	3 53	3 42	3 32	12
16	10 40	10 09	9 41	9 13	8 47	8 21	7 59	7 35	7 15	6 55	6 34	6 16	16
20	16 40	15 52	15 08	14 24	13 44	13 04	12 28	11 52	11 20	10 48	10 16	9 48	20
24	24 00	22 51	21 47	20 45	19 47	18 49	17 57	17 05	16 19	15 34	14 47	14 06	24
28	32 40	31 06	29 40	28 13	26 55	25 37	24 26	23 16	22 13	21 10	20 07	19 13	28
32	42 40	40 37	38 45	36 51	35 09	33 27	31 55	30 23	29 01	27 38	26 17	25 06	32
36	54 00	51 25	49 02	46 40	44 30	42 20	40 24	38 27	36 43	35 00	33 16	31 45	36
40	66 40	63 28	60 32	57 36	54 56	52 16	49 52	47 28	45 20	43 12	41 04	39 12	40
44	80 40	76 48	73 15	69 42	66 28	63 14	60 21	57 26	54 51	52 17	49 41	47 26	44
48	96 00	91 23	87 10	82 56	79 06	75 16	71 48	68 19	65 15	62 12	59 08	56 27	48
52	...	107 15	102 18	97 20	92 50	88 20	84 16	80 13	76 37	73 00	69 24	66 15	52
56	...	...	...	...	107 40	102 26	97 45	93 02	88 51	84 41	80 29	76 50	56
60	...	...	...	...	...	...	112 12	106 48	102 00	97 12	92 24	88 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.50	2.38	2.27	2.16	2.06	1.96	1.87	1.78	1.70	1.62	1.54	1.47	$\Delta_1 h$
Log.	0.397 94	0.376 58	0.356 03	0.334 45	0.313 87	0.292 26	0.271 84	0.250 42	0.230 45	0.209 52	0.187 52	0.167 32	Log.
Limit	39	40	41	42	44	45	46	47	48	50	52	54	Minutes
Meridian	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 21	0 20	0 19	0 19	0 17	0 16	0 15	0 14	0 14	0 13	0 12	4
8	1 30	1 25	1 21	1 17	1 13	1 09	1 05	1 01	0 58	0 55	0 51	0 49	8
12	3 22	3 11	3 02	2 53	2 44	2 36	2 27	2 19	2 11	2 04	1 56	1 50	12
16	5 58	5 41	5 22	5 07	4 52	4 36	4 21	4 05	3 53	3 40	3 28	3 14	16
20	9 20	8 52	8 24	8 00	7 36	7 12	6 48	6 24	6 04	5 44	5 24	5 04	20
24	13 26	12 46	12 06	11 31	10 57	10 22	9 48	9 13	8 44	8 16	7 47	7 18	24
28	18 18	17 23	16 28	15 41	14 53	14 07	13 20	12 33	11 54	11 14	10 35	9 56	28
32	23 54	22 42	21 30	20 29	19 27	18 26	17 24	16 23	15 32	14 40	13 49	12 58	32
36	30 14	28 44	27 13	25 55	24 38	23 20	22 02	20 44	19 39	18 35	17 30	16 25	36
40	37 20	35 28	33 36	32 00	30 24	28 48	27 12	25 36	24 16	22 56	21 36	20 16	40
44	45 10	42 55	40 39	38 43	36 47	34 51	32 55	30 58	29 21	27 45	26 08	24 31	44
48	53 46	51 04	48 23	46 05	43 46	41 28	39 10	36 52	34 57	33 01	31 06	29 09	48
52	63 06	59 56	56 47	54 05	51 22	48 40	45 58	43 16	41 01	38 45	36 30	34 15	52
56	73 10	69 31	65 51	62 43	59 35	56 27	53 19	50 10	47 33	44 57	42 20	39 43	56
60	84 00	79 48	75 36	72 00	68 24	64 48	61 12	57 36	54 36	51 36	48 36	45 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.40	1.33	1.26	1.20	1.14	1.08	1.02	0.96	0.91	0.86	0.81	0.76	$\Delta_1 h$
Log.	0.146 13	0.123 85	0.100 37	0.079 18	0.056 90	0.033 42	0.008 60	9.982 27	9.959 04	9.934 50	9.908 49	9.880 81	Log.
Limit	56	57	59	61	63	65	66	68	70	72	74	76	Minutes
Meridian	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 37	1 31	1 27	1 23	1 19	1 16	1 13	1 10	1 07	1 05	1 02	1 00	4
8	6 27	6 07	5 50	5 33	5 18	5 05	4 53	4 41	4 30	4 20	4 10	4 02	8
12	14 30	13 45	13 07	12 29	11 56	11 26	10 58	10 32	10 08	9 45	9 25	9 05	12
16	25 46	24 27	23 17	22 11	21 12	20 18	19 30	18 44	18 00	17 19	16 43	16 07	16
20	40 16	38 12	36 24	34 40	33 08	31 44	30 28	29 16	28 08	27 04	26 08	25 12	20
24	57 59	55 00	52 25	49 55	47 42	45 42	43 52	42 09	40 31	38 59	37 38	36 17	24
28	78 55	74 53	71 21	67 57	64 57	62 10	59 43	57 22	55 09	53 03	51 14	49 24	28
32	...	...	...	...	...	81 14	78 00	74 55	72 01	69 17	66 54	64 31	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	..	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.04	5.73	5.46	5.20	4.97	4.76	4.57	4.39	4.22	4.06	3.92	3.78	$\triangle_1 h$
Log.	0.781 04	0.758 15	0.737 19	0.716 00	0.696 36	0.677 61	0.659 92	0.642 46	0.625 31	0.608 53	0.593 29	0.577 49	Log.
Limit	22	23	24	25	26	26	27	28	29	30	31	31	Minutes
Meridian	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 59	0 56	0 54	0 53	0 51	0 50	0 48	0 46	0 46	0 44	0 43	0 42	4
8	3 53	3 46	3 39	3 32	3 26	3 19	3 13	3 07	3 02	2 58	2 52	2 47	8
12	8 45	8 28	8 13	7 56	7 42	7 27	7 15	7 02	6 50	6 39	6 27	6 17	12
16	15 35	15 04	14 35	14 08	13 42	13 17	12 53	12 30	12 10	11 49	11 29	11 11	16
20	24 20	23 32	22 48	22 04	21 24	20 44	20 08	19 32	19 00	18 28	17 56	17 28	20
24	35 03	33 53	32 50	31 47	30 49	29 52	29 00	28 07	27 22	26 35	25 50	25 10	24
28	47 41	46 08	44 42	43 15	41 57	40 38	39 28	38 18	37 14	36 12	35 09	34 14	28
32	62 17	60 15	58 22	56 29	54 47	53 04	51 32	50 01	48 38	47 17	45 54	44 42	32
36	78 51	76 15	73 52	71 30	69 20	67 11	65 14	63 17	61 34	59 50	58 07	56 36	36
40	...	...	91 12	88 16	85 36	82 56	80 32	78 08	76 00	73 52	71 44	69 52	40
44	...	...	...	...	...	...	...	...	...	...	86 48	84 33	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.65	3.53	3.42	3.31	3.21	3.11	3.02	2.93	2.85	2.77	2.69	2.62	$\triangle_1 h$
Log.	0.562 29	0.547 77	0.534 03	0.519 83	0.506 51	0.492 76	0.480 01	0.466 87	0.454 84	0.442 48	0.429 75	0.418 30	Log.
Limit	32	32	33	34	34	35	36	37	38	39	39	40	Minutes
Meridian	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	Altitudes

Latitude 18° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 41	0 39	0 38	0 38	0 36	0 35	0 35	0 34	0 33	0 32	0 31	0 30	4
8	2 43	2 39	2 35	2 30	2 27	2 23	2 19	2 15	2 13	2 09	2 05	2 02	8
12	6 07	5 58	5 49	5 38	5 30	5 21	5 14	5 05	4 58	4 51	4 43	4 37	12
16	10 53	10 34	10 19	10 02	9 46	9 31	9 18	9 03	8 50	8 37	8 21	8 11	16
20	17 00	16 32	16 08	15 40	15 16	14 52	14 32	14 08	13 48	13 28	13 04	12 48	20
24	24 29	23 48	23 14	22 34	21 59	21 24	20 56	20 22	19 52	19 24	18 49	18 26	24
28	33 19	32 25	31 38	30 42	29 56	29 09	28 29	27 42	27 03	26 24	25 37	25 06	28
32	43 31	42 20	41 18	40 06	39 05	38 04	37 12	36 10	35 20	34 28	33 27	32 46	32
36	55 05	53 34	52 16	50 46	49 28	48 10	47 06	45 48	44 43	43 38	42 20	41 28	36
40	68 00	66 08	64 32	62 40	61 04	59 28	58 08	56 32	55 12	53 52	52 16	51 12	40
44	82 17	80 01	78 05	75 50	73 53	71 57	70 21	68 25	66 48	65 11	63 14	61 57	44
48	...	95 14	92 56	90 14	87 56	85 38	83 42	81 24	79 29	77 34	75 16	73 44	48
52	...	...	...	105 54	103 12	100 30	98 14	95 32	93 17	91 02	88 20	86 32	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.55	2.48	2.42	2.35	2.29	2.23	2.18	2.12	2.07	2.02	1.96	1.92	$\triangle_1 h$
Log.	0.406 54	0.394 45	0.383 82	0.371 07	0.359 84	0.348 30	0.338 46	0.326 34	0.315 97	0.305 35	0.292 26	0.283 30	Log.
Limit	41	42	44	45	46	47	47	47	48	49	50	51	Minutes
Meridian	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 29	0 28	0 27	0 27	0 27	0 26	0 25	0 24	0 23	0 22	0 22	4
8	2 00	1 56	1 54	1 51	1 48	1 45	1 42	1 40	1 37	1 35	1 33	1 30	8
12	4 29	4 22	4 16	4 09	4 03	3 56	3 50	3 45	3 39	3 34	3 28	3 22	12
16	7 59	7 46	7 33	7 23	7 13	7 00	6 50	6 39	6 29	6 18	6 08	5 58	16
20	12 28	12 08	11 48	11 32	11 16	10 56	10 40	10 24	10 08	9 52	9 36	9 20	20
24	17 57	17 29	16 59	16 36	16 14	15 45	15 22	14 59	14 36	14 12	13 49	13 26	24
28	24 26	23 47	23 08	22 37	22 05	21 25	20 54	20 23	19 52	19 21	18 49	18 18	28
32	31 55	31 03	30 13	29 32	28 50	27 59	27 18	26 37	25 56	25 16	24 35	23 54	32
36	40 24	39 19	38 14	37 22	36 31	35 26	34 34	33 42	32 50	31 58	31 06	30 14	36
40	49 52	48 32	47 12	46 08	45 04	43 44	42 40	41 36	40 32	39 28	38 24	37 20	40
44	60 21	58 44	57 07	55 49	54 32	52 55	51 38	50 20	49 03	47 45	46 27	45 10	44
48	71 48	69 53	67 56	66 24	64 53	62 58	61 26	59 54	58 22	56 50	55 18	53 46	48
52	84 16	82 01	79 46	77 58	76 09	73 54	72 06	70 18	68 30	66 42	64 54	63 06	52
56	97 45	95 08	92 31	90 25	88 20	85 43	83 38	81 32	79 27	77 21	75 15	73 10	56
60	112 12	109 12	106 12	103 48	101 24	98 24	96 00	93 36	91 12	88 48	86 24	84 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.87	1.82	1.77	1.73	1.69	1.64	1.60	1.56	1.52	1.48	1.44	1.40	$\triangle_1 h$
Log.	0.271 84	0.260 07	0.247 97	0.238 05	0.227 89	0.214 84	0.204 12	0.193 12	0.181 84	0.170 26	0.158 36	0.146 13	Log.
Limit	51	52	53	54	55	56	57	58	59	60	61	62	Minutes
Meridian	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 21	0 20	0 20	0 19	0 19	0 19	0 18	0 17	0 17	0 16	0 15	4
8	1 28	1 25	1 23	1 21	1 18	1 16	1 13	1 11	1 10	1 07	1 05	1 03	8
12	3 17	3 11	3 06	3 02	2 56	2 51	2 45	2 41	2 37	2 31	2 27	2 23	12
16	5 51	5 41	5 30	5 22	5 12	5 05	4 55	4 47	4 39	4 29	4 21	4 13	16
20	9 08	8 52	8 36	8 24	8 08	7 56	7 40	7 28	7 16	7 00	6 48	6 36	20
24	13 09	12 46	12 23	12 06	11 43	11 26	11 03	10 46	10 28	10 05	9 48	9 30	24
28	17 54	17 23	16 52	16 28	15 57	15 33	15 01	14 38	14 15	13 43	13 20	12 57	28
32	23 23	22 42	22 01	21 30	20 49	20 18	19 37	19 06	18 36	17 55	17 24	16 54	32
36	29 36	28 44	27 52	27 13	26 21	25 43	24 51	24 12	23 33	22 41	22 02	21 23	36
40	36 32	35 28	34 24	33 36	32 32	31 44	30 40	29 52	29 04	28 00	27 12	26 24	40
44	44 13	42 55	41 37	40 39	39 22	38 24	37 07	36 09	35 10	33 53	32 55	31 56	44
48	52 36	51 04	49 32	48 23	46 51	45 41	44 09	43 00	41 51	40 19	39 10	38 01	48
52	61 44	59 56	58 08	56 47	54 29	53 37	51 49	50 28	49 07	47 19	45 58	44 37	52
56	71 37	69 31	67 25	65 51	63 46	62 12	60 07	58 33	56 58	54 53	53 19	51 44	56
60	82 12	79 48	77 24	75 36	73 12	71 24	69 00	67 12	65 24	63 00	61 12	59 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.37	1.33	1.29	1.26	1.22	1.19	1.15	1.12	1.09	1.05	1.02	0.99	$\Delta_1 h$
Log.	0.136 72	0.123 85	0.110 59	0.100 37	0.086 36	0.075 55	0.060 70	0.049 22	0.037 43	0.021 19	0.008 60	9.995 64	Log.
Limit	63	64	66	67	68	70	72	74	75	76	77	78	Minutes
Meridian	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 14	0 14	0 14	0 13	0 12	0 12	0 11	0 11	...	...	...	4
8	1 01	0 58	0 57	0 55	0 53	0 51	0 49	0 47	0 45	...	...	...	8
12	2 17	2 13	2 08	2 04	1 59	1 54	1 50	1 45	1 41	...	...	...	12
16	4 03	3 55	3 48	3 40	3 33	3 22	3 14	3 07	2 59	...	...	...	16
20	6 20	6 08	5 56	5 44	5 32	5 16	5 04	4 52	4 40	...	...	...	20
24	9 07	8 50	8 33	8 16	7 58	7 35	7 18	7 00	6 43	...	...	...	24
28	12 25	12 02	11 38	11 14	10 51	10 20	9 56	9 33	9 09	...	...	...	28
32	16 13	15 42	15 19	14 40	14 10	13 29	12 58	12 28	11 57	...	...	...	32
36	20 31	19 52	19 14	18 35	17 56	17 04	16 25	15 46	15 07	...	...	...	36
40	25 20	24 32	23 44	22 56	22 08	21 04	20 16	19 28	18 40	...	...	...	40
44	30 39	29 41	28 43	27 45	26 47	25 29	24 31	23 33	22 35	...	...	...	44
48	36 29	35 20	34 10	33 01	31 52	30 18	29 09	28 00	26 51	...	...	...	48
52	42 49	41 28	40 06	38 45	37 24	35 36	34 15	32 54	31 33	...	...	...	52
56	49 39	48 05	46 31	44 57	43 23	41 17	39 43	38 09	36 35	...	...	...	56
60	57 00	55 12	53 24	51 36	49 48	47 24	45 36	43 48	42 00	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.95	0.92	0.89	0.86	0.83	0.79	0.76	0.73	0.70	...	...	...	$\Delta_1 h$
Log.	9.977 72	9.963 79	9.949 39	9.934 50	9.919 08	9.897 63	9.880 81	9.863 32	9.845 10	... ...	... ...	... ...	Log.
Limit	80	81	82	83	84	85	86	87	88	89	90	91	Minutes
Meridian	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	Altitudes

Latitude 19° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 31	1 36	1 42	1 47	1 55	2 03	2 11	2 22	2 34	2 49	3 07	3 29	4
8	6 05	6 25	6 46	7 11	7 38	8 09	8 46	9 27	10 17	11 16	12 28	13 58	8
12	13 41	14 25	15 14	16 09	17 11	18 20	19 42	21 16	23 08	25 21	28 03	31 25	12
16	24 19	25 39	27 06	28 43	30 33	32 36	35 02	37 48	41 08	45 03	...	...	16
20	38 00	40 04	42 20	44 52	47 44	50 56	54 44	...	...	...	...	...	20
24	54 43	57 42	60 58	64 36	...	...	...	...	...	...	...	...	24
28	74 29	78 32	82 59	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	5.70	6.01	6.35	6.73	7.16	7.64	8.21	8.86	9.64	10.56	11.69	13.09	Δ_1h
Log.	0.755 87	0.778 87	0.802 77	0.828 02	0.854 91	0.883 09	0.914 34	0.947 43	0.984 08	1.023 66	1.067 81	1.116 94	Log.
Limit	23	22	21	20	19	18	17	16	15	14	13	12	Minutes
Meridian	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 58	4 37	5 31	...	...	...	...	...	...	...	...	...	4
8	15 53	18 28	22 03	...	...	...	...	...	...	...	...	...	8
12	35 46	...	...	...	...	...	...	...	...	...	...	...	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	14.90	17.31	20.67	...	...	...	...	...	...	...	...	...	Δ_1h
Log.	1.173 19	1.238 30	1.315 34	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	11	10	8	6	4	3	1	0	1	4	6	7	Minutes
Meridian	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	Altitudes

Latitude 19° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	5 11	4 18	3 39	3 10	2 47	2 30	2 14	2 03	1 52	1 43	1 35	1 28	4
8	20 46	17 10	14 35	12 41	11 11	9 58	9 00	8 09	7 28	6 53	6 20	5 53	8
12	...	38 38	32 50	28 32	25 10	22 26	20 14	18 21	16 48	15 28	14 17	13 15	12
16	...	...	...	...	44 42	39 54	35 58	32 39	29 52	27 28	25 23	23 33	16
20	...	...	...	...	...	...	56 12	51 00	46 40	42 56	39 40	36 48	20
24	...	...	...	...	...	...	...	...	67 12	61 49	57 07	53 00	24
28	...	...	...	...	...	...	...	...	...	84 09	77 45	72 08	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	19.46	16.10	13.69	11.89	10.48	9.35	8.43	7.65	7.00	6.44	5.95	5.52	$\triangle_1 h$
Log.	1.289 14	1.206 83	1.136 40	1.075 18	1.020 36	0.970 81	0.925 83	0.883 66	0.845 10	0.808 89	0.774 52	0.741 94	Log.
Limit	8	9	10	12	14	15	16	18	19	21	22	23	Minutes
Meridian	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 23	1 17	1 11	1 07	1 03	1 00	0 56	0 54	0 51	0 47	0 46	0 43	4
8	5 29	5 07	4 48	4 30	4 14	4 00	3 46	3 34	3 22	3 11	3 02	2 52	8
12	12 20	11 31	10 47	10 08	9 32	8 59	8 28	8 01	7 35	7 11	6 49	6 27	12
16	21 56	20 29	19 09	18 00	16 56	15 57	15 04	14 15	13 29	12 45	12 07	11 29	16
20	34 16	32 00	29 56	28 08	26 28	24 56	23 32	22 16	21 04	19 56	18 56	17 56	20
24	49 21	46 05	43 05	40 31	38 06	35 54	33 53	32 04	30 21	28 42	27 16	25 50	24
28	67 09	62 43	58 41	55 09	51 53	48 52	46 08	43 38	41 17	39 05	37 06	35 09	28
32	...	81 55	76 38	72 01	67 46	63 50	60 15	57 00	53 55	51 02	48 28	45 54	32
36	...	...	...	...	...	...	76 15	72 09	68 16	64 35	61 21	58 07	36
40	...	...	...	...	...	...	...	89 04	84 16	79 44	75 44	71 44	40
44	...	...	...	...	...	...	...	...	...	...	...	86 48	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.14	4.80	4.49	4.22	3.97	3.74	3.53	3.34	3.16	2.99	2.84	2.69	$\triangle_1 h$
Log.	0.710 96	0.681 24	0.652 25	0.625 31	0.598 79	0.572 87	0.547 77	0.523 75	0.499 69	0.475 67	0.453 32	0.429 75	Log.
Limit	25	26	27	29	30	31	32	33	34	35	36	37	Minutes
Meridian	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	Altitudes

Latitude 19° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 41	0 39	0 37	0 35	0 34	0 32	0 30	0 29	0 27	0 27	0 25	0 23	4
8	2 44	2 37	2 28	2 21	2 14	2 08	2 01	1 56	1 51	1 45	1 40	1 36	8
12	6 09	5 52	5 34	5 17	5 02	4 48	4 34	4 20	4 09	3 56	3 45	3 35	12
16	10 55	10 24	9 54	9 23	8 58	8 32	8 06	7 44	7 23	7 00	6 39	6 21	16
20	17 04	16 16	15 28	14 40	14 00	13 20	12 40	12 04	11 32	10 56	10 24	9 56	20
24	24 35	23 25	22 17	21 07	20 10	19 12	18 14	17 23	16 36	15 45	14 59	14 18	24
28	33 27	31 53	30 19	28 45	27 26	26 08	24 50	23 39	22 37	21 25	20 23	19 29	28
32	43 41	41 39	39 35	37 33	35 50	34 08	32 26	30 53	29 32	27 59	26 37	25 26	32
36	55 18	52 42	50 07	47 31	45 22	43 12	41 02	39 06	37 22	35 26	33 42	32 11	36
40	68 16	65 04	61 52	58 40	56 00	53 20	50 40	48 16	46 08	43 44	41 36	39 44	40
44	82 36	78 43	74 52	70 59	67 46	64 32	61 18	58 24	55 49	52 55	50 20	48 04	44
48	. . .	93 42	89 05	84 29	80 38	76 48	72 58	69 30	66 24	62 58	59 54	57 13	48
52	. . .	. . .	104 33	99 09	94 38	90 08	85 38	81 34	77 58	73 54	70 18	67 09	52
56	. . .	. . .	. . .	. . .	. . .	104 32	99 18	94 36	90 25	85 43	81 32	77 52	56
60	. . .	. . .	. . .	. . .	. . .	. . .	114 00	108 36	103 48	98 24	93 36	89 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.56	2.44	2.32	2.20	2.10	2.00	1.90	1.81	1.73	1.64	1.56	1.49	△₁h
Log.	0.408 24	0.387 39	0.365 49	0.342 42	0.322 22	0.301 03	0.278 75	0.257 68	0.238 05	0.214 84	0.193 12	0.173 19	Log.
Limit	38	39	40	42	44	45	46	47	48	50	52	54	Minutes
Meridian	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 20	0 19	0 19	0 17	0 16	0 15	0 14	0 14	0 13	0 12	4
8	1 31	1 26	1 22	1 17	1 13	1 10	1 06	1 02	0 58	0 55	0 52	0 50	8
12	3 25	3 14	3 05	2 54	2 45	2 37	2 28	2 20	2 13	2 05	1 58	1 51	12
16	6 03	5 46	5 27	5 10	4 55	4 39	4 24	4 08	3 55	3 43	3 30	3 17	16
20	9 28	9 00	8 32	8 04	7 40	7 16	6 52	6 28	6 08	5 48	5 28	5 08	20
24	13 38	12 58	12 17	11 37	11 03	10 28	9 53	9 18	8 50	8 21	7 53	7 23	24
28	18 34	17 38	16 44	15 49	15 01	14 15	13 28	12 41	12 02	11 22	10 43	10 04	28
32	24 14	23 02	21 51	20 39	19 37	18 36	17 35	16 34	15 42	14 51	13 59	13 09	32
36	30 40	29 10	27 39	26 08	24 51	23 33	22 15	20 57	19 52	18 48	17 43	16 38	36
40	37 52	36 00	34 08	32 16	30 40	29 04	27 28	25 52	24 32	23 12	21 52	20 32	40
44	45 49	43 34	41 18	39 02	37 07	35 10	33 14	31 18	29 41	28 05	26 28	24 51	44
48	54 32	51 50	49 09	46 28	44 09	41 51	39 33	37 15	35 20	33 24	31 29	29 32	48
52	64 00	60 50	57 41	54 32	51 49	49 07	46 25	43 43	41 28	39 12	36 57	34 42	52
56	74 13	70 34	66 54	63 14	60 07	56 58	53 50	50 42	48 05	45 29	42 52	40 15	56
60	85 12	81 00	76 48	72 36	69 00	65 24	61 48	58 12	55 12	52 12	49 12	46 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.42	1.35	1.28	1.21	1.15	1.09	1.03	0.97	0.92	0.87	0.82	0.77	△₁h
Log.	0.152 29	0.130 33	0.107 21	0.082 79	0.060 70	0.037 43	0.012 84	9.986 77	9.963 79	9.939 52	9.913 81	9.886 49	Log.
Limit	55	57	59	61	63	64	65	67	69	71	73	75	Minutes
Meridian	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	Altitudes

Latitude 19° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 31	1 26	1 23	1 19	1 16	1 13	1 10	1 07	1 05	1 02	1 00	0 59	4
8	6 05	5 48	5 31	5 16	5 04	4 51	4 40	4 29	4 19	4 10	4 02	3 53	8
12	13 41	13 02	12 26	11 53	11 23	10 55	10 29	10 05	9 43	9 23	9 03	8 44	12
16	24 19	23 10	22 06	21 07	20 13	19 25	18 39	17 55	17 17	16 41	16 05	15 32	16
20	38 00	36 12	34 32	33 00	31 36	30 20	29 08	28 00	27 00	26 04	25 08	24 16	20
24	54 43	52 07	49 44	47 31	45 30	43 41	41 57	40 19	38 53	37 32	36 11	34 57	24
28	74 29	70 58	67 41	64 41	61 54	59 27	57 06	54 53	52 55	51 06	49 16	47 33	28
32	...	...	...	...	80 54	77 39	74 34	71 41	69 07	66 44	64 21	62 07	32
36	...	...	...	...	...	...	...	...	...	...	...	78 38	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.70	5.43	5.18	4.95	4.74	4.55	4.37	4.20	4.05	3.91	3.77	3.64	$\triangle_1 h$
Log.	0.755 87	0.734 80	0.714 33	0.694 61	0.675 78	0.658 01	0.640 48	0.623 25	0.607 46	0.592 18	0.576 34	0.561 10	Log.
Limit	23	24	25	26	27	27	28	28	30	30	31	31	Minutes
Meridian	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 56	0 54	0 53	0 51	0 50	0 48	0 46	0 46	0 44	0 43	0 42	0 41	4
8	3 46	3 39	3 32	3 26	3 19	3 13	3 07	3 02	2 58	2 53	2 47	2 43	8
12	8 28	8 11	7 56	7 42	7 27	7 15	7 02	6 50	6 39	6 29	6 17	6 07	12
16	15 04	14 33	14 08	13 42	13 17	12 53	12 30	12 10	11 49	11 31	11 11	10 53	16
20	23 32	22 44	22 04	21 24	20 44	20 08	19 32	19 00	18 28	18 00	17 28	17 00	20
24	33 53	32 44	31 47	30 49	29 52	29 00	28 07	27 22	26 35	25 55	25 10	24 29	24
28	46 08	44 34	43 15	41 57	40 38	39 28	38 18	37 14	36 12	35 17	34 14	33 19	28
32	60 15	58 12	56 29	54 47	53 04	51 32	50 01	48 38	47 17	46 05	44 42	43 31	32
36	76 15	73 39	71 30	69 20	67 11	65 14	63 17	61 34	59 50	58 19	56 36	55 05	36
40	...	90 56	88 16	85 36	82 56	80 32	78 08	76 00	73 52	72 00	69 52	68 00	40
44	...	...	...	...	...	...	...	...	...	87 07	84 33	82 17	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.53	3.41	3.31	3.21	3.11	3.02	2.93	2.85	2.77	2.70	2.62	2.55	$\triangle_1 h$
Log.	0.547 77	0.532 75	0.519 83	0.506 51	0.492 76	0.480 01	0.466 87	0.454 84	0.442 48	0.431 36	0.418 30	0.406 54	Log.
Limit	32	33	34	35	35	36	37	38	39	40	41	42	Minutes
Meridian	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	Altitudes

Latitude 19° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 39	0 38	0 38	0 37	0 36	0 35	0 34	0 33	0 32	0 31	0 30	0 30	4
8	2 40	2 35	2 31	2 27	2 24	2 19	2 16	2 13	2 10	2 06	2 03	2 00	8
12	5 59	5 49	5 40	5 31	5 23	5 14	5 06	5 00	4 82	4 46	4 38	4 31	12
16	10 37	10 19	10 04	9 49	9 33	9 18	9 06	8 52	8 40	8 26	8 14	8 01	16
20	16 36	16 08	15 44	15 20	14 56	14 32	14 12	13 52	13 32	13 12	12 52	12 32	20
24	23 54	23 14	22 40	22 05	21 30	20 56	20 27	19 58	19 29	19 00	18 31	18 03	24
28	32 33	31 38	30 50	30 03	29 16	28 29	27 50	27 11	26 32	25 83	25 14	24 34	28
32	42 30	41 18	40 16	39 15	38 14	37 12	36 21	35 20	34 39	33 48	32 57	32 05	32
36	53 47	52 16	50 59	49 41	48 23	47 06	46 01	44 56	43 81	42 46	41 41	40 37	36
40	66 24	64 32	62 56	61 20	59 44	58 08	56 48	55 28	54 08	52 48	51 28	50 08	40
44	80 20	78 05	76 09	74 13	72 16	70 21	68 44	67 07	65 30	63 53	62 16	60 40	44
48	95 37	92 56	90 37	88 19	86 01	83 42	81 46	79 52	77 57	76 02	74 07	72 11	48
52	...	...	106 21	103 39	100 57	98 14	95 59	93 44	91 29	89 14	86 59	84 43	52
56	...	...	...	...	...	...	...	...	106 06	103 29	100 52	98 15	56
60	...	...	...	...	...	...	...	...	...	...	...	112 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.49	2.42	2.36	2.30	2.24	2.18	2.13	2.08	2.03	1.98	1.93	1.88	$\triangle_1 h$
Log.	0.396 20	0.383 82	0.372 91	0.361 73	0.350 25	0.338 46	0.328 38	0.318 06	0.307 50	0.296 67	0.285 56	0.274 16	Log.
Limit	42	43	44	45	46	47	48	48	49	50	51	52	Minutes
Meridian	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 29	0 28	0 28	0 27	0 27	0 26	0 25	0 25	0 24	0 23	0 22	0 22	4
8	1 57	1 55	1 52	1 49	1 46	1 43	1 41	1 39	1 36	1 34	1 31	1 29	8
12	4 23	4 18	4 11	4 05	3 59	3 53	3 48	3 42	3 36	3 31	3 25	3 20	12
16	7 49	7 38	7 25	7 15	7 05	6 55	6 44	6 34	6 24	6 13	6 03	5 56	16
20	12 12	11 56	11 36	11 20	11 04	10 48	10 32	10 16	10 00	9 44	9 28	9 16	20
24	17 34	17 11	16 42	16 19	15 57	15 34	15 10	14 47	14 24	14 01	13 38	13 21	24
28	23 55	23 24	22 44	22 13	21 41	21 10	20 39	20 07	19 36	19 05	18 34	18 10	28
32	31 13	30 33	29 42	29 01	28 19	27 38	26 58	26 17	25 36	24 55	24 14	23 43	32
36	39 32	38 40	37 35	36 43	35 52	35 00	34 08	33 16	32 24	31 32	30 40	30 02	36
40	48 48	47 44	46 24	45 20	44 16	43 12	42 08	41 04	40 00	38 56	37 52	37 04	40
44	59 03	57 45	56 08	54 51	53 34	52 17	50 59	49 41	48 24	47 06	45 49	44 51	44
48	70 16	68 42	66 47	65 15	63 44	62 12	60 40	59 08	57 36	56 04	54 32	53 22	48
52	82 28	80 40	78 25	76 37	74 48	73 00	71 12	69 24	67 36	65 48	64 00	62 38	52
56	95 39	93 33	90 56	88 51	86 46	84 41	82 35	80 29	78 24	76 18	74 13	72 39	56
60	109 48	107 24	104 24	102 00	99 36	97 12	94 48	92 24	90 00	87 36	85 12	83 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.83	1.79	1.74	1.70	1.66	1.62	1.58	1.54	1.50	1.46	1.42	1.39	$\triangle_1 h$
Log.	0.262 45	0.252 85	0.240 55	0.230 45	0.220 11	0.209 52	0.198 66	0.187 52	0.176 09	0.164 35	0.152 29	0.143 01	Log.
Limit	52	53	54	55	56	57	58	59	60	61	62	63	Minutes
Meridian	35	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	0 22	0 21	0 20	0 20	0 19	0 19	0 19	0 18	0 17	0 17	0 16	0 15	4
8	1 26	1 23	1 22	1 20	1 17	1 15	1 13	1 10	1 08	1 07	1 04	1 02	8
12	3 14	3 08	3 05	2 59	2 54	2 48	2 44	2 38	2 34	2 30	2 25	2 22	12
16	5 46	5 36	5 27	5 17	5 10	5 00	4 52	4 42	4 34	4 26	4 19	4 10	16
20	9 00	8 44	8 32	8 16	8 04	7 48	7 36	7 20	7 08	6 56	6 44	6 32	20
24	12 58	12 35	12 17	11 54	11 37	11 14	10 57	10 34	10 16	9 59	9 42	9 24	24
28	17 38	17 07	16 44	16 12	15 49	15 17	14 53	14 22	13 59	13 35	13 12	12 49	28
32	23 02	22 21	21 51	21 10	20 39	19 58	19 27	18 46	18 16	17 45	17 14	16 44	32
36	29 10	28 18	27 39	26 47	26 08	25 17	24 38	23 46	23 07	22 28	21 49	21 10	36
40	36 00	34 56	34 08	33 04	32 16	31 12	30 24	29 20	28 32	27 44	26 56	26 08	40
44	43 34	42 16	41 18	40 00	39 02	37 46	36 47	35 30	34 32	33 33	32 35	31 37	44
48	51 50	50 18	49 09	47 37	46 28	44 55	43 46	42 14	41 05	39 56	38 47	37 38	48
52	60 50	59 02	57 41	55 53	54 32	52 43	51 22	49 34	48 13	46 52	45 31	44 10	52
56	70 34	68 28	66 54	64 48	63 14	61 10	59 35	57 30	55 56	54 21	52 47	51 13	56
60	81 00	78 36	76 48	74 24	72 36	70 12	68 24	66 00	64 12	62 24	60 36	58 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.35	1.31	1.28	1.24	1.21	1.17	1.14	1.10	1.07	1.04	1.01	0.98	$\triangle_1 h$
Log.	0.130 33	0.117 27	0.107 21	0.093 42	0.082 79	0.068 19	0.056 90	0.041 39	0.029 38	0.017 03	0.004 32	9.991 23	Log.
Limit	64	65	67	68	69	71	73	75	76	77	78	79	Minutes
Meridian	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	0 15	0 14	0 14	0 14	0 13	0 12	0 12	0 11	...	...	...	...	4
8	1 01	0 58	0 56	0 54	0 52	0 51	0 49	0 46	...	...	...	...	8
12	2 17	2 11	2 07	2 02	1 58	1 54	1 50	1 44	...	...	...	...	12
16	4 03	3 53	3 45	3 38	3 30	3 22	3 14	3 04	...	...	...	...	16
20	6 20	6 04	5 52	5 40	5 28	5 16	5 04	4 48	...	...	...	...	20
24	9 07	8 44	8 27	8 10	7 53	7 35	7 18	6 55	...	...	...	...	24
28	12 25	11 54	11 30	11 06	10 43	10 20	9 56	9 25	...	...	...	...	28
32	16 13	15 32	15 01	14 30	13 59	13 29	12 58	12 17	...	...	...	...	32
36	20 31	19 39	19 01	18 22	17 43	17 04	16 25	15 33	...	...	...	...	36
40	25 20	24 16	23 28	22 40	21 52	21 04	20 16	19 12	...	...	...	...	40
44	30 39	29 21	28 24	27 26	26 28	25 29	24 31	23 14	...	...	...	...	44
48	36 29	34 57	33 47	32 38	31 29	30 18	29 09	27 37	...	...	...	...	48
52	42 49	41 01	39 39	38 18	36 57	35 36	34 15	32 27	...	...	...	...	52
56	49 39	47 33	46 00	44 26	42 52	41 17	39 43	37 38	...	...	...	...	56
60	57 00	54 36	52 48	51 00	49 12	47 24	45 36	43 12	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.95	0.91	0.88	0.85	0.82	0.79	0.76	0.72	...	...	...	...	$\triangle_1 h$
Log.	9.977 72	9.959 04	9.944 48	9.929 42	9.913 81	9.897 63	9.880 81	9.857 33	... ...	... ...	... ...	... ...	Log.
Limit	80	81	82	83	84	85	86	87	88	89	90	91	Minutes
Meridian	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	Altitudes

Latitude 20° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 26	1 31	1 35	1 41	1 47	1 54	2 01	2 10	2 20	2 33	2 47	3 05	4
8	5 45	6 03	6 22	6 43	7 07	7 34	8 05	8 41	9 23	10 11	11 10	12 22	8
12	12 56	13 36	14 20	15 07	16 02	17 02	18 12	19 32	21 06	22 55	25 07	27 49	12
16	23 00	24 12	25 28	26 53	28 30	30 18	32 20	34 44	37 30	40 45	44 37	...	16
20	35 56	37 48	39 48	42 00	44 32	47 20	50 32	54 16	...	...	...	...	20
24	51 45	54 26	57 18	60 29	64 08	...	...	...	...	...	...	...	24
28	70 26	74 05	78 01	82 19	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	..	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.39	5.67	5.97	6.30	6.68	7.10	7.58	8.14	8.79	9.55	10.46	11.58	$\triangle_1 h$
Log.	0.731 59	0.753 58	0.775 97	0.799 34	0.824 78	0.851 26	0.879 67	0.910 62	0.943 99	0.980 00	1.019 53	1.063 71	Log.
Limit	24	23	22	21	20	19	18	17	16	15	14	13	Minutes
Meridian	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 27	3 56	4 35	5 27	...	...	...	...	...	...	...	...	4
8	13 50	15 44	18 16	21 48	...	...	...	...	...	...	...	...	8
12	31 08	35 24	...	...	...	...	...	...	...	...	...	...	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	..	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	12.97	14.75	17.13	20.45	...	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	1.112 94	1.168 79	1.233 76	1.310 69	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	12	11	10	8	6	4	3	1	0	2	4	6	Minutes
Meridian	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	5 07	4 14	3 35	3 07	2 45	2 27	2 12	2 00	1 50	1 41	1 34	4
8	...	20 28	16 56	14 24	12 30	11 00	9 49	8 51	8 02	7 20	6 44	6 14	8
12	...	...	38 05	32 23	28 06	24 46	22 05	19 54	18 04	16 31	15 10	14 01	12
16	...	...	...	...	...	44 02	39 15	35 22	32 08	29 21	26 58	24 55	16
20	...	...	...	...	...	...	...	55 16	50 12	45 52	42 08	38 56	20
24	...	...	...	...	...	...	...	...	...	66 03	60 41	56 04	24
28	...	...	...	...	...	...	...	...	...	...	82 35	76 18	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	19.19	15.87	13.49	11.71	10.32	9.20	8.29	7.53	6.88	6.32	5.84	$\triangle_1$h
Log.	... ...	1.283 07	1.200 58	1.130 01	1.068 56	1.013 68	0.963 79	0.918 55	0.876 79	0.837 59	0.800 72	0.766 41	Log.
Limit	7	8	9	10	11	13	15	16	17	19	21	22	Minutes
Meridian	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 26	1 21	1 15	1 10	1 06	1 02	0 59	0 55	0 52	0 49	0 46	0 44	4
8	5 47	5 23	5 01	4 42	4 24	4 09	3 54	3 41	3 29	3 18	3 06	2 58	8
12	13 01	12 06	11 17	10 34	9 54	9 20	8 47	8 17	7 50	7 25	7 01	6 39	12
16	23 07	21 30	20 03	18 46	17 38	16 36	15 37	14 43	13 54	13 11	12 27	11 49	16
20	36 08	33 36	31 20	29 20	27 32	25 56	24 24	23 00	21 44	20 36	19 28	18 28	20
24	52 02	48 23	45 07	42 14	39 39	37 21	35 09	33 07	31 18	29 40	28 02	26 35	24
28	70 50	65 51	61 25	57 30	53 58	50 50	47 49	45 05	42 36	40 23	38 10	36 12	28
32	...	...	80 13	75 06	70 29	66 23	62 27	58 53	55 38	52 44	49 50	47 17	32
36	...	...	...	...	...	...	79 04	74 31	70 25	66 45	63 04	59 50	36
40	...	...	...	...	...	...	...	92 00	86 56	82 24	77 52	73 52	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	5.42	5.04	4.70	4.40	4.13	3.89	3.66	3.45	3.26	3.09	2.92	2.77	$\triangle_1$h
Log.	0.734 00	0.702 43	0.672 11	0.643 45	0.615 95	0.589 95	0.563 48	0.537 82	0.513 22	0.489 96	0.465 38	0.442 48	Log.
Limit	24	25	27	28	29	30	31	32	33	34	35	36	Minutes
Meridian	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	Altitudes

Latitude 20° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	0 42	0 40	0 38	0 36	0 35	0 33	0 31	0 30	0 28	0 27	0 25	0 24	4
8	2 48	2 40	2 32	2 24	2 17	2 11	2 04	1 58	1 53	1 47	1 42	1 36	8
12	6 18	6 00	5 41	5 24	5 08	4 54	4 40	4 26	4 14	4 00	3 49	3 37	12
16	11 14	10 40	10 07	9 36	9 08	8 42	8 16	7 54	7 30	7 08	6 47	6 27	16
20	17 32	16 40	15 48	15 00	14 16	13 36	12 56	12 20	11 44	11 08	10 36	10 04	20
24	25 15	24 00	22 45	21 36	20 33	19 35	18 37	17 46	16 54	16 02	15 16	14 30	24
28	34 22	32 40	30 58	29 24	27 57	26 39	25 21	24 10	23 00	21 49	20 47	19 44	28
32	44 53	42 40	40 27	38 24	36 31	34 49	33 07	31 34	30 02	28 30	27 08	25 46	32
36	56 49	54 00	51 12	48 36	46 14	44 04	41 54	39 58	38 01	36 05	34 21	32 37	36
40	70 08	66 40	63 12	60 00	57 04	54 24	51 44	49 20	46 56	44 32	42 24	40 16	40
44	84 52	80 40	76 39	72 36	69 03	65 49	62 35	59 42	56 47	53 54	51 18	48 43	44
48	...	96 00	91 00	86 24	82 10	78 20	74 30	71 02	67 33	64 07	61 03	57 59	48
52	...	...	106 48	101 24	96 26	91 56	87 26	83 22	79 19	75 15	71 39	68 03	52
56	...	...	...	...	...	106 37	101 23	96 42	91 59	87 18	83 06	78 55	56
60	...	...	...	...	...	...	...	111 00	105 36	100 12	95 24	90 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.63	2.50	2.37	2.25	2.14	2.04	1.94	1.85	1.76	1.67	1.59	1.51	$\Delta_1 h$
Log.	0.419 96	0.397 94	0.374 75	0.352 18	0.330 41	0.309 63	0.287 80	0.267 17	0.245 51	0.222 72	0.201 40	0.178 98	Log.
Limit	37	38	39	41	42	44	45	46	47	49	51	53	Minutes
Meridian	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	0 22	0 22	0 20	0 19	0 19	0 18	0 17	0 15	0 14	0 14	0 13	0 12	4
8	1 33	1 27	1 23	1 19	1 14	1 10	1 07	1 02	0 59	0 56	0 52	0 49	8
12	3 28	3 16	3 06	2 57	2 47	2 38	2 30	2 22	2 14	2 07	1 58	1 50	12
16	6 08	5 48	5 30	5 15	4 57	4 42	4 26	4 10	3 58	3 45	3 30	3 14	16
20	9 36	9 04	8 36	8 12	7 44	7 20	6 56	6 32	6 12	5 52	5 28	5 04	20
24	13 49	13 04	12 23	11 48	11 09	10 34	9 59	9 24	8 55	8 27	7 53	7 18	24
28	18 49	17 46	16 52	16 05	15 09	14 22	13 35	12 49	12 10	11 30	10 43	9 56	28
32	24 35	23 12	22 01	21 00	19 47	18 46	17 45	16 44	15 53	15 01	13 59	12 58	32
36	31 06	29 23	27 52	26 34	25 04	23 46	22 28	21 10	20 05	19 01	17 43	16 25	36
40	38 24	36 16	34 24	32 48	30 56	29 20	27 44	26 08	24 48	23 28	21 52	20 16	40
44	46 27	43 53	41 37	39 41	37 26	35 30	33 33	31 37	30 00	28 24	26 28	24 31	44
48	55 18	52 13	49 32	47 14	44 32	42 14	39 56	37 38	35 43	33 47	31 29	29 09	48
52	64 54	61 17	58 08	55 26	52 16	49 34	46 52	44 10	41 55	39 39	36 57	34 15	52
56	75 15	71 05	67 25	64 17	60 38	57 30	54 21	51 13	48 36	46 00	42 52	39 43	56
60	86 24	81 36	77 24	73 48	69 36	66 00	62 24	58 48	55 48	52 48	49 12	45 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.44	1.36	1.29	1.23	1.16	1.10	1.04	0.98	0.93	0.88	0.82	0.76	$\Delta_1 h$
Log.	0.158 36	0.133 54	0.110 59	0.089 91	0.064 46	0.041 39	0.017 03	9.991 23	9.968 48	9.944 48	9.913 81	9.880 81	Log.
Limit	54	56	58	60	62	64	66	68	70	72	74	76	Minutes
Meridian	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 26	1 23	1 18	1 15	1 12	1 10	1 07	1 04	1 02	1 00	0 58	0 56	4
8	5 45	5 29	5 14	5 02	4 50	4 38	4 28	4 18	4 09	4 01	3 52	3 45	8
12	12 56	12 21	11 49	11 20	10 52	10 26	10 03	9 40	9 20	9 02	8 42	8 27	12
16	23 00	21 59	20 59	20 08	19 20	18 34	17 53	17 12	16 36	16 02	15 30	15 01	16
20	35 56	34 20	32 48	31 28	30 12	29 00	27 56	26 52	25 56	25 04	24 12	23 28	20
24	51 45	49 27	47 14	45 19	43 29	41 46	40 14	38 41	37 21	36 06	34 51	33 48	24
28	70 26	67 17	64 18	61 41	59 12	56 50	54 45	52 40	50 20	49 08	47 26	46 00	28
32	...	...	...	80 33	77 19	74 14	71 30	68 47	66 23	64 10	61 57	60 04	32
36	...	...	...	...	...	...	...	...	...	...	78 25	76 02	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.39	5.15	4.92	4.72	4.53	4.35	4.19	4.03	3.89	3.76	3.63	3.52	$\triangle_1 h$
Log.	0.731 59	0.711 81	0.691 97	0.673 94	0.656 10	0.638 49	0.622 21	0.605 31	0.589 95	0.575 19	0.559 91	0.546 54	Log.
Limit	24	25	26	27	28	28	29	30	30	31	32	33	Minutes
Meridian	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 54	0 53	0 51	0 50	0 48	0 47	0 46	0 44	0 43	0 42	0 41	0 39	4
8	3 39	3 31	3 25	3 19	3 13	3 07	3 02	2 58	2 53	2 48	2 44	2 40	8
12	8 11	7 55	7 41	7 27	7 15	7 02	6 50	6 39	6 29	6 18	6 09	5 59	12
16	14 33	14 05	13 39	13 17	12 53	12 30	12 10	11 49	11 31	11 14	10 55	10 37	16
20	22 44	22 00	21 20	20 44	20 08	19 32	19 00	18 28	18 00	17 32	17 04	16 36	20
24	32 44	31 41	30 43	29 52	29 00	28 07	27 22	26 35	25 55	25 15	24 35	23 54	24
28	44 34	43 07	41 49	40 38	39 28	38 18	37 14	36 12	35 17	34 22	33 27	32 33	28
32	58 12	56 19	54 37	53 04	51 32	50 01	48 38	47 17	46 05	44 53	43 41	42 30	32
36	73 39	71 17	69 07	67 11	65 14	63 17	61 34	59 50	58 19	56 49	55 18	53 47	36
40	90 56	88 00	85 20	82 56	80 32	78 08	76 00	73 52	72 00	70 08	68 16	66 24	40
44	...	...	...	...	...	...	...	...	87 07	84 52	82 36	80 20	44
48	...	...	...	...	...	...	...	...	...	...	...	95 37	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.41	3.30	3.20	3.11	3.02	2.93	2.85	2.77	2.70	2.63	2.56	2.49	$\triangle_1 h$
Log.	0.532 75	0.518 51	0.505 15	0.492 76	0.480 01	0.466 87	0.454 84	0.442 48	0.431 36	0.419 96	0.408 24	0.396 20	Log.
Limit	33	34	35	36	36	37	37	38	39	40	41	42	Minutes
Meridian	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	Altitudes

Latitude 20° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 38	0 37	0 36	0 35	0 35	0 33	0 33	0 31	0 31	0 30	0 30	4
8	2 36	2 31	2 28	2 24	2 20	2 17	2 14	2 11	2 07	2 04	2 01	1 58	8
12	5 50	5 40	5 32	5 24	5 15	5 08	5 01	4 54	4 47	4 40	4 32	4 26	12
16	10 22	10 04	9 52	9 36	9 21	9 08	8 55	8 42	8 29	8 16	8 04	7 54	16
20	16 12	15 44	15 24	15 00	14 36	14 16	13 56	13 36	13 16	12 56	12 36	12 20	20
24	23 19	22 40	22 11	21 36	21 02	20 33	20 04	19 35	19 06	18 37	18 09	17 46	24
28	31 46	30 50	30 11	29 24	28 37	27 57	27 19	26 39	26 01	25 21	24 42	24 10	28
32	41 29	40 16	39 25	38 24	37 22	36 31	35 40	34 49	33 58	33 07	32 15	31 34	32
36	52 29	50 59	49 54	48 36	47 19	46 14	45 09	44 04	42 59	41 54	40 50	39 58	36
40	64 48	62 56	61 36	60 00	58 24	57 04	55 44	54 24	53 04	51 44	50 24	49 20	40
44	78 24	76 09	74 32	72 36	70 40	69 03	67 26	65 49	64 12	62 35	60 59	59 42	44
48	93 19	90 37	88 42	86 24	84 05	82 10	80 15	78 20	76 25	74 30	72 34	71 02	48
52	...	106 21	104 06	101 24	98 41	96 26	94 11	91 56	89 41	87 26	85 10	83 22	52
56	...	...	...	...	...	...	...	106 37	104 01	101 23	98 47	96 42	56
60	...	...	...	...	...	...	...	...	...	...	113 24	111 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.43	2.36	2.31	2.25	2.19	2.14	2.09	2.04	1.99	1.94	1.89	1.85	$\triangle_1 h$
Log.	0.385 61	0.372 91	0.363 61	0.352 18	0.340 44	0.330 41	0.320 15	0.309 63	0.298 85	0.287 80	0.276 46	0.267 17	Log.
Limit	43	44	45	46	47	48	48	48	49	50	51	52	Minutes
Meridian	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 29	0 28	0 27	0 27	0 26	0 25	0 25	0 24	0 23	0 22	0 22	0 22	4
8	1 55	1 53	1 50	1 47	1 44	1 42	1 39	1 36	1 35	1 33	1 30	1 28	8
12	4 19	4 14	4 06	4 00	3 54	3 49	3 43	3 37	3 34	3 28	3 22	3 17	12
16	7 41	7 30	7 18	7 08	6 58	6 47	6 37	6 27	6 18	6 08	5 58	5 51	16
20	12 00	11 44	11 24	11 08	10 52	10 36	10 20	10 04	9 52	9 36	9 20	9 08	20
24	17 17	16 54	16 25	16 02	15 39	15 16	14 53	14 30	14 12	13 49	13 26	13 09	24
28	23 31	23 00	22 21	21 49	21 18	20 47	20 15	19 44	19 21	18 49	18 18	17 54	28
32	30 43	30 02	29 11	28 30	27 49	27 08	26 27	25 46	25 16	24 35	23 54	23 23	32
36	38 53	38 01	36 56	36 05	35 13	34 21	33 29	32 37	31 58	31 06	30 14	29 36	36
40	48 00	46 56	45 36	44 32	43 28	42 24	41 20	40 16	39 28	38 24	37 20	36 32	40
44	58 05	56 47	55 10	53 54	52 36	51 18	50 01	48 43	47 45	46 27	45 10	44 13	44
48	69 07	67 33	65 38	64 07	62 35	61 03	59 31	57 59	56 50	55 18	53 46	52 36	48
52	81 07	79 19	77 04	75 15	73 27	71 39	69 51	68 03	66 42	64 54	63 06	61 44	52
56	94 05	91 59	89 22	87 18	85 12	83 06	81 01	78 55	77 21	75 15	73 10	71 36	56
60	108 00	105 36	102 36	100 12	97 48	95 24	93 00	90 36	88 48	86 24	81 00	82 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.80	1.76	1.71	1.67	1.63	1.59	1.55	1.51	1.48	1.44	1.40	1.37	$\triangle_1 h$
Log.	0.255 27	0.245 51	0.233 00	0.222 72	0.212 19	0.201 40	0.190 33	0.178 98	0.170 26	0.158 36	0.146 13	0.136 72	Log.
Limit	53	54	55	56	57	58	59	61	61	62	63	64	Minutes
Meridian	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 21	0 21	0 20	0 19	0 19	0 19	0 18	0 17	0 17	0 16	0 16	0 15	4
8	1 25	1 23	1 21	1 19	1 16	1 14	1 12	1 10	1 08	1 06	1 04	1 02	8
12	3 11	3 07	3 02	2 57	2 51	2 47	2 42	2 37	2 33	2 28	2 24	2 20	12
16	5 41	5 33	5 22	5 15	5 05	4 57	4 50	4 39	4 31	4 24	4 16	4 08	16
20	8 52	8 40	8 24	8 12	7 56	7 44	7 32	7 16	7 04	6 52	6 40	6 28	20
24	12 46	12 29	12 06	11 48	11 26	11 09	10 51	10 28	10 11	9 53	9 36	9 18	24
28	17 23	16 59	16 28	16 05	15 33	15 09	14 46	14 15	13 51	13 28	13 04	12 41	28
32	22 42	22 11	21 30	21 00	20 18	19 47	19 17	18 36	18 05	17 35	17 04	16 34	32
36	28 44	28 05	27 13	26 34	25 43	25 04	24 25	23 33	22 54	22 15	21 36	20 57	36
40	35 28	34 40	33 36	32 48	31 44	30 56	30 08	29 04	28 16	27 28	26 40	25 52	40
44	42 55	41 57	40 39	39 41	38 24	37 26	36 28	35 10	34 12	33 14	32 16	31 18	44
48	51 04	49 55	48 23	47 14	45 41	44 32	43 23	41 51	40 42	39 33	38 24	37 15	48
52	59 56	58 35	56 47	55 26	53 37	52 16	55 55	49 07	47 46	46 25	45 04	43 43	52
56	69 31	67 57	65 51	64 17	62 12	60 38	59 04	56 58	55 24	53 50	52 16	50 42	56
60	79 48	78 00	75 36	73 48	71 24	69 36	67 48	65 24	63 36	61 48	60 00	58 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.33	1.30	1.26	1.23	1.19	1.16	1.13	1.09	1.06	1.03	1.00	0.97	$\Delta_1 h$
Log.	0.123 85	0.113 94	0.100 37	0.089 91	0.075 55	0.064 46	0.053 08	0.037 43	0.025 31	0.012 84	0.00 ...	9.986 77	Log.
Limit	65	66	68	69	70	71	73	75	76	77	78	79	Minutes
Meridian	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 14	0 14	0 14	0 13	0 12	0 12	...	...	...	...	...	4
8	1 00	0 58	0 55	0 54	0 51	0 50	0 48	...	...	...	...	...	8
12	2 16	2 11	2 05	2 01	1 56	1 52	1 48	...	...	...	...	...	12
16	4 00	3 53	3 43	3 35	3 28	3 19	3 12	...	...	...	...	...	16
20	6 16	6 04	5 48	5 36	5 24	5 12	5 00	...	...	...	...	...	20
24	9 01	8 44	8 21	8 04	7 47	7 29	7 12	...	...	...	...	...	24
28	12 17	11 54	11 22	10 58	10 35	10 12	9 48	...	...	...	...	...	28
32	16 03	15 32	14 51	14 20	13 49	13 19	12 48	...	...	...	...	...	32
36	20 18	19 39	18 48	18 09	17 30	16 51	16 12	...	...	...	...	...	36
40	25 04	24 16	23 12	22 24	21 36	20 48	20 00	...	...	...	...	...	40
44	30 19	29 21	28 05	27 06	26 08	25 10	24 12	...	...	...	...	...	44
48	36 06	34 57	33 24	32 15	31 06	29 55	28 46	...	...	...	...	...	48
52	42 22	41 01	39 12	37 51	36 30	35 09	33 48	...	...	...	...	...	52
56	49 07	47 33	45 29	43 54	42 20	40 46	39 12	...	...	...	...	...	56
60	56 24	54 36	52 12	50 24	48 36	46 48	45 00	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.94	0.91	0.87	0.84	0.81	0.78	0.75	...	...	...	...	...	$\Delta_1 h$
Log.	9.973 13	9.959 04	9.939 52	9.924 28	9.908 49	9.892 09	9.875 06	... ...	... ...	... ...	... ...	... ...	Log.
Limit	80	81	82	83	84	85	86	87	88	89	90	91	Minutes
Meridian	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	Altitudes

Latitude 21° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 22	1 26	1 30	1 34	1 40	1 46	1 53	2 00	2 09	2 19	2 31	2 46	4
8	5 27	5 43	6 00	6 18	6 40	7 04	7 31	8 01	8 37	9 18	10 06	11 03	8
12	12 17	12 52	13 30	14 13	15 00	15 54	16 54	18 03	19 22	20 54	22 43	24 52	12
16	21 51	22 52	24 02	25 15	26 40	28 18	30 02	32 05	34 26	37 10	40 21	44 12	16
20	34 08	35 44	37 32	39 28	41 40	44 12	46 56	50 08	53 48	58 04	...	...	20
24	49 10	51 28	54 03	56 50	60 00	63 39	...	...	...	...	...	...	24
28	66 54	70 02	73 34	77 22	81 40	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	5.12	5.36	5.63	5.92	6.25	6.63	7.04	7.52	8.07	8.71	9.46	10.36	$\triangle_1$h
Log.	0.709 27	0.729 16	0.750 51	0.772 32	0.795 88	0.821 51	0.847 57	0.876 22	0.906 87	0.940 02	0.975 89	1.015 36	Log.
Limit	25	24	23	22	21	20	19	18	17	16	15	14	Minutes
Meridian	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 03	3 25	3 53	4 31	5 23	...	...	...	...	...	...	...	4
8	12 14	13 41	15 34	18 04	21 34	...	...	...	...	...	...	...	8
12	27 31	30 47	35 01	40 40	...	...	...	...	...	...	...	...	12
16	48 53	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	11.46	12.83	14.59	16.94	20.22	...	...	...	...	...	...	...	$\triangle_1$h
Log.	1.059 18	1.108 23	1.164 06	1.228 91	1.305 78	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	13	12	11	9	8	7	6	4	2	0	2	3	Minutes
Meridian	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	Altitudes

Latitude 21° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	5 02	4 10	3 32	3 04	2 43	2 25	2 11	1 58	1 49	1 39	4
8	...	...	20 09	16 40	14 10	12 17	10 49	9 39	8 41	7 53	7 13	6 38	8
12	...	...	...	37 30	31 53	27 39	24 21	21 43	19 33	17 44	16 14	14 54	12
16	...	...	...	...	...	...	43 19	38 37	34 47	31 32	28 50	26 30	16
20	...	...	...	...	...	...	...	...	54 20	49 16	45 04	41 24	20
24	...	...	...	...	...	...	...	...	...	...	64 54	59 37	24
28	...	...	...	...	...	...	...	...	...	...	...	81 09	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	...	...	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	18.90	15.63	13.28	11.52	10.15	9.05	8.15	7.39	6.76	6.21	$\triangle_1 h$
Log.	... ...	... ...	1.276 46	1.193 96	1.123 20	1.061 45	1.006 47	0.956 65	0.911 16	0.868 64	0.829 95	0.793 09	Log.
Limit	5	7	8	9	10	12	14	15	17	18	19	21	Minutes
Meridian	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 31	1 25	1 18	1 14	1 09	1 05	1 01	0 57	0 54	0 51	0 48	0 46	4
8	6 07	5 40	5 16	4 55	4 36	4 19	4 03	3 49	3 36	3 24	3 13	3 02	8
12	13 45	12 44	11 52	11 03	10 20	9 42	9 07	8 36	8 05	7 39	7 13	6 50	12
16	24 27	22 40	21 04	19 41	18 24	17 14	16 13	15 16	14 23	13 37	12 51	12 10	16
20	38 12	35 24	32 56	30 44	28 44	26 56	25 20	23 52	22 28	21 16	20 04	19 00	20
24	55 00	50 59	47 25	44 16	41 23	38 47	36 29	34 22	32 21	30 38	28 54	27 22	24
28	74 53	69 23	64 33	60 14	56 19	52 47	49 39	46 47	44 02	41 41	39 20	37 14	28
32	...	...	...	78 40	73 33	68 57	64 51	61 06	57 31	54 26	51 22	48 38	32
36	...	...	...	...	...	...	...	77 20	72 48	68 55	65 01	61 34	36
40	...	...	...	...	...	...	...	...	89 52	85 04	80 16	76 00	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.73	5.31	4.94	4.61	4.31	4.04	3.80	3.58	3.37	3.19	3.01	2.85	$\triangle_1 h$
Log.	0.758 15	0.725 09	0.693 73	0.663 70	0.634 48	0.606 38	0.579 78	0.553 88	0.527 63	0.503 79	0.478 57	0.454 84	Log.
Limit	23	25	26	27	28	29	30	31	32	33	34	35	Minutes
Meridian	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	Altitudes

Latitude 21° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 41	0 38	0 37	0 35	0 33	0 31	0 30	0 28	0 27	0 26	0 24	4
8	2 53	2 44	2 36	2 28	2 20	2 13	2 06	2 00	1 55	1 49	1 42	1 38	8
12	6 29	6 09	5 50	5 32	5 15	5 00	4 46	4 31	4 18	4 05	3 51	3 40	12
16	11 31	10 55	10 22	9 52	9 21	8 52	8 26	8 01	7 38	7 15	6 53	6 32	16
20	18 00	17 04	16 12	15 24	14 36	13 52	13 12	12 32	11 56	11 20	10 44	10 12	20
24	25 55	24 35	23 19	22 11	21 02	19 58	19 00	18 03	17 11	16 19	15 28	14 41	24
28	35 17	33 27	31 46	30 11	28 37	27 11	25 53	24 34	23 24	22 13	21 02	20 00	28
32	46 05	43 41	41 29	39 25	37 22	35 30	33 48	32 05	30 33	29 01	27 28	26 07	32
36	58 19	55 18	52 29	49 54	47 19	44 56	42 46	40 37	38 40	36 43	34 47	33 03	36
40	72 00	68 16	64 48	61 36	58 24	55 28	52 48	50 08	47 44	45 20	42 56	40 48	40
44	87 07	82 36	78 24	74 32	70 40	67 07	63 53	60 40	57 45	54 51	51 57	49 22	44
48	...	98 18	93 19	88 42	84 05	79 52	76 02	72 11	68 42	65 15	61 49	58 45	48
52	...	...	...	104 06	98 41	93 44	89 14	84 43	80 40	76 37	72 33	68 57	52
56	...	...	...	...	...	108 43	103 29	98 15	93 33	88 51	84 09	79 58	56
60	...	...	...	...	...	...	...	112 48	107 24	102 00	96 36	91 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.70	2.56	2.43	2.31	2.19	2.08	1.98	1.88	1.79	1.70	1.61	1.53	$\Delta_1 h$
Log.	0.431 36	0.408 24	0.385 61	0.363 61	0.340 44	0.318 06	0.296 67	0.274 16	0.252 85	0.230 45	0.206 83	0.184 69	Log.
Limit	36	38	39	40	41	43	45	46	47	48	50	52	Minutes
Meridian	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 22	0 21	0 20	0 19	0 18	0 17	0 15	0 15	0 14	0 13	0 12	4
8	1 34	1 28	1 23	1 20	1 15	1 11	1 07	1 03	1 00	0 56	0 53	0 50	8
12	3 31	3 19	3 08	2 59	2 50	2 39	2 31	2 23	2 16	2 07	1 59	1 52	12
16	6 13	5 53	5 36	5 17	5 02	4 45	4 29	4 13	4 00	3 45	3 33	3 19	16
20	9 44	9 12	8 44	8 16	7 52	7 24	7 00	6 36	6 16	5 52	5 32	5 12	20
24	14 01	13 15	12 35	11 54	11 20	10 40	10 05	9 30	9 01	8 27	7 58	7 29	24
28	19 05	18 02	17 07	16 12	15 25	14 30	13 43	12 57	12 17	11 30	10 51	10 12	28
32	24 55	23 33	22 21	21 10	20 08	18 56	17 55	16 54	16 03	15 01	14 10	13 19	32
36	31 32	29 49	28 18	26 47	25 30	23 59	22 41	21 23	20 18	19 01	17 56	16 51	36
40	38 56	36 48	34 56	33 04	31 28	29 36	28 00	26 24	25 04	23 28	22 08	20 48	40
44	47 06	44 32	42 16	40 00	38 05	35 49	33 53	31 56	30 19	28 24	26 47	25 10	44
48	56 04	52 59	50 18	47 37	45 18	42 37	40 19	38 01	36 06	33 47	31 52	29 55	48
52	65 48	62 11	59 02	55 53	53 10	50 01	47 19	44 37	42 22	39 39	37 24	35 09	52
56	76 18	72 08	68 28	64 48	61 41	58 01	54 53	51 44	49 07	46 00	43 23	40 46	56
60	87 36	82 48	78 36	74 24	70 48	66 36	63 00	59 24	56 24	52 48	49 48	46 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.46	1.38	1.31	1.24	1.18	1.11	1.05	0.99	0.94	0.88	0.83	0.78	$\Delta_1 h$
Log.	0.164 35	0.139 88	0.117 27	0.093 42	0.071 88	0.045 32	0.021 19	9.995 64	9.973 13	9.944 48	9.919 08	9.892 09	Log.
Limit	54	55	57	59	61	62	64	66	68	70	72	74	Minutes
Meridian	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	Altitudes

Latitude 21° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 22	1 18	1 15	1 12	1 09	1 07	1 04	1 02	1 00	0 58	0 56	0 54	4
8	5 27	5 13	5 00	4 48	4 37	4 27	4 17	4 08	4 00	3 51	3 45	3 38	8
12	12 17	11 44	11 15	10 48	10 23	10 00	9 39	9 19	8 59	8 41	8 25	8 10	12
16	21 51	20 52	20 01	19 12	18 29	17 48	17 09	16 33	15 57	15 27	14 59	14 30	16
20	34 08	32 36	31 16	30 00	28 52	27 48	26 48	25 52	24 56	24 08	23 24	22 40	20
24	49 10	46 57	45 02	43 12	41 34	40 02	38 36	37 15	35 54	34 46	33 42	32 38	24
28	66 54	63 54	61 17	58 48	56 35	54 29	52 32	50 42	48 52	47 18	45 52	44 26	28
32	...	...	80 02	76 48	73 53	71 10	68 36	66 13	63 50	61 46	59 54	58 02	32
36	...	...	...	...	...	...	...	...	...	78 12	75 49	73 26	36
40	...	...	...	...	...	...	...	...	...	...	...	90 40	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.12	4.89	4.69	4.50	4.33	4.17	4.02	3.88	3.74	3.62	3.51	3.40	$\triangle_1 h$
Log.	0.709 27	0.689 31	0.671 17	0.653 21	0.636 49	0.620 14	0.604 23	0.588 83	0.572 87	0.558 71	0.545 31	0.531 48	Log.
Limit	25	26	27	28	29	29	29	30	31	32	33	33	Minutes
Meridian	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 52	0 51	0 50	0 48	0 46	0 46	0 44	0 43	0 42	0 41	0 39	0 38	4
8	3 31	3 24	3 18	3 13	3 07	3 02	2 58	2 53	2 48	2 44	2 40	2 36	8
12	7 54	7 39	7 26	7 13	7 02	6 50	6 39	6 29	6 18	6 09	5 59	5 50	12
16	14 02	13 37	13 14	12 51	12 30	12 10	11 49	11 31	11 14	10 55	10 37	10 22	16
20	21 56	21 16	20 40	20 04	19 32	19 00	18 28	18 00	17 32	17 04	16 36	16 12	20
24	31 35	30 38	29 46	28 54	28 07	27 22	26 35	25 55	25 15	24 35	23 54	23 19	24
28	43 00	41 41	40 30	39 20	38 18	37 14	36 12	35 17	34 22	33 27	32 33	31 46	28
32	56 09	54 26	52 54	51 22	50 01	48 38	47 17	46 05	44 53	43 41	42 30	41 29	32
36	71 04	68 55	66 58	65 01	63 17	61 34	59 50	58 19	56 49	55 18	53 47	52 29	36
40	87 44	85 04	82 40	80 16	78 08	76 00	73 52	72 00	70 08	68 16	66 24	64 48	40
44	...	...	...	...	...	...	...	87 07	84 52	82 36	80 20	78 24	44
48	...	...	...	...	...	...	...	...	...	...	95 37	93 19	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.29	3.19	3.10	3.01	2.93	2.85	2.77	2.70	2.63	2.56	2.49	2.43	$\triangle_1 h$
Log.	0.517 20	0.503 79	0.491 36	0.478 57	0.466 87	0.454 84	0.442 48	0.431 36	0.419 96	0.408 24	0.396 20	0.385 61	Log.
Limit	34	35	36	37	37	38	38	39	40	41	42	43	Minutes
Meridian	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	Altitudes

Latitude 21° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 37	0 36	0 35	0 35	0 33	0 33	0 31	0 31	0 30	0 30	0 29	4
8	2 32	2 28	2 24	2 21	2 17	2 14	2 11	2 07	2 04	2 01	1 59	1 56	8
12	5 41	5 32	5 24	5 17	5 08	5 01	4 54	4 47	4 41	4 34	4 28	4 20	12
16	10 07	9 52	9 36	9 23	9 08	8 55	8 42	8 29	8 19	8 06	7 56	7 44	16
20	15 48	15 24	15 00	14 40	14 16	13 56	13 36	13 16	13 00	12 40	12 24	12 04	20
24	22 45	22 11	21 36	21 07	20 33	20 04	19 35	19 06	18 43	18 14	17 52	17 23	24
28	30 58	30 11	29 24	28 45	27 57	27 19	26 39	26 01	25 29	24 50	24 18	23 39	28
32	40 27	39 25	38 24	37 33	36 31	35 40	34 49	33 58	33 17	32 26	31 44	30 53	32
36	51 12	49 54	48 36	47 31	46 14	45 09	44 04	42 59	42 07	41 02	40 11	39 06	36
40	63 12	61 36	60 00	58 40	57 04	55 44	54 24	53 04	52 00	50 40	49 36	48 16	40
44	76 39	74 32	72 36	70 59	69 03	67 26	65 49	64 12	62 55	61 18	60 01	58 24	44
48	91 00	88 42	86 24	84 29	82 10	80 15	78 20	76 25	74 53	72 58	71 25	69 30	48
52	106 48	104 06	101 24	99 09	96 26	94 11	91 56	89 41	87 53	85 38	83 49	81 34	52
56	...	...	...	...	111 51	109 14	106 37	104 01	101 55	99 18	97 13	94 36	56
60	...	...	...	...	...	...	...	...	...	114 00	111 36	108 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.37	2.31	2.25	2.20	2.14	2.09	2.04	1.99	1.95	1.90	1.86	1.81	$\triangle_1 h$
Log.	0.374 75	0.363 61	0.352 18	0.342 42	0.330 41	0.320 15	0.309 63	0.298 85	0.290 03	0.278 75	0.269 51	0.257 68	Log.
Limit	44	45	46	47	48	49	49	50	51	52	53	53	Minutes
Meridian	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 27	0 27	0 27	0 26	0 25	0 24	0 23	0 23	0 22	0 22	0 22	4
8	1 54	1 51	1 48	1 45	1 42	1 40	1 38	1 36	1 33	1 31	1 28	1 26	8
12	4 16	4 09	4 03	3 56	3 50	3 45	3 40	3 35	3 29	3 25	3 19	3 14	12
16	7 33	7 23	7 13	7 00	6 50	6 39	6 32	6 21	6 11	6 03	5 53	5 46	16
20	11 48	11 32	11 16	10 56	10 40	10 24	10 12	9 56	9 40	9 28	9 12	9 00	20
24	16 59	16 36	16 14	15 45	15 22	14 59	14 41	14 18	13 55	13 38	13 15	12 58	24
28	23 08	22 37	22 05	21 25	20 54	20 23	20 00	19 29	18 57	18 34	18 02	17 38	28
32	30 13	29 32	28 50	27 59	27 18	26 37	26 07	25 26	24 45	24 14	23 33	23 02	32
36	38 14	37 22	36 31	35 26	34 34	33 42	33 03	32 11	31 19	30 40	29 49	29 10	36
40	47 12	46 08	45 04	43 44	42 40	41 36	40 48	39 44	38 40	37 52	36 48	36 00	40
44	57 07	55 49	54 32	52 55	51 38	50 20	49 22	48 04	46 47	45 49	44 32	43 34	44
48	67 56	66 24	64 53	62 58	61 26	59 54	58 45	57 13	55 41	54 32	52 59	51 50	48
52	79 46	77 58	76 09	73 54	72 06	70 18	68 57	67 09	65 21	64 00	62 11	60 50	52
56	92 31	90 25	88 20	85 43	83 38	81 32	79 58	77 52	75 37	74 13	72 08	70 34	56
60	106 12	103 48	101 24	98 24	96 00	93 36	91 48	89 24	87 00	85 12	82 48	81 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.77	1.73	1.69	1.64	1.60	1.56	1.53	1.49	1.45	1.42	1.38	1.35	$\triangle_1 h$
Log.	0.247 97	0.238 05	0.227 89	0.214 84	0.204 12	0.193 12	0.184 69	0.173 19	0.161 37	0.152 29	0.139 88	0.130 33	Log.
Limit	54	55	56	57	58	59	60	61	62	63	63	64	Minutes
Meridian	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 21	0 20	0 20	0 19	0 19	0 19	0 18	0 17	0 17	0 16	0 15	0 15	4
8	1 23	1 22	1 20	1 17	1 15	1 13	1 11	1 09	1 07	1 05	1 03	1 01	8
12	3 08	3 05	3 00	2 54	2 50	2 45	2 39	2 36	2 31	2 27	2 23	2 19	12
16	5 36	5 27	5 20	5 10	5 02	4 55	4 45	4 36	4 29	4 21	4 13	4 05	16
20	8 44	8 32	8 20	8 04	7 52	7 40	7 24	7 12	7 00	6 48	6 36	6 24	20
24	12 35	12 17	12 00	11 37	11 20	11 03	10 40	10 22	10 05	9 48	9 30	9 13	24
28	17 07	16 44	16 20	15 49	15 25	15 01	14 30	14 07	13 43	13 20	12 57	12 33	28
32	22 21	21 51	21 20	20 39	20 08	19 37	18 56	18 26	17 55	17 24	16 54	16 23	32
36	28 18	27 39	27 00	26 08	25 30	24 51	23 59	23 20	22 41	22 02	21 23	20 44	36
40	34 56	34 08	33 20	32 16	31 28	30 40	29 36	28 48	28 00	27 12	26 24	25 36	40
44	42 16	41 18	40 20	39 02	38 05	37 07	35 49	34 51	33 53	32 55	31 56	30 58	44
48	50 18	49 09	48 00	46 28	45 18	44 09	42 37	41 28	40 19	39 10	38 01	36 52	48
52	59 02	57 41	56 20	54 32	53 10	51 49	50 01	48 40	47 19	45 58	44 37	43 16	52
56	68 28	66 54	65 20	63 14	61 41	60 07	58 01	56 27	54 53	53 19	51 44	50 10	56
60	78 36	76 48	75 00	72 36	70 48	69 00	66 36	64 48	63 00	61 12	59 24	57 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.31	1.28	1.25	1.21	1.18	1.15	1.11	1.08	1.05	1.02	0.99	0.96	$\triangle_1 h$
Log.	0.117 27	0.107 21	0.096 91	0.082 79	0.071 88	0.060 70	0.045 32	0.033 42	0.021 19	0.008 60	9.995 64	9.982 27	Log.
Limit	65	67	69	70	71	72	74	76	77	78	79	80	Minutes
Meridian	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	0 14	0 13	0 13	0 12	...	...	...	...	...	...	4
8	0 59	0 57	0 55	0 54	0 51	0 50	...	...	...	...	...	...	8
12	2 14	2 10	2 05	2 01	1 56	1 52	...	...	...	...	...	...	12
16	3 58	3 50	3 43	3 35	3 28	3 19	...	...	...	...	...	...	16
20	6 12	6 00	5 48	5 36	5 24	5 12	...	...	...	...	...	...	20
24	8 55	8 38	8 21	8 04	7 47	7 29	...	...	...	...	...	...	24
28	12 10	11 46	11 22	10 58	10 35	10 12	...	...	...	...	...	...	28
32	15 53	15 22	14 51	14 20	13 49	13 19	...	...	...	...	...	...	32
36	20 05	19 26	18 48	18 09	17 30	16 51	...	...	...	...	...	...	36
40	24 48	24 00	23 12	22 24	21 36	20 48	...	...	...	...	...	...	40
44	30 00	29 02	28 05	27 06	26 08	25 10	...	...	...	...	...	...	44
48	35 43	34 34	33 24	32 15	31 06	29 55	...	...	...	...	...	...	48
52	41 55	40 34	39 12	37 51	36 30	35 09	...	...	...	...	...	...	52
56	48 36	47 02	45 29	43 54	42 20	40 46	...	...	...	...	...	...	56
60	55 48	54 00	52 12	50 24	48 36	46 48	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.93	0.90	0.87	0.84	0.81	0.78	...	...	...	...	...	...	$\triangle_1 h$
Log.	9.968 48	9.954 24	9.939 52	9.924 28	9.908 49	9.892 09	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	81	82	83	84	85	86							Minutes
Meridian	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	Altitudes

Latitude 22° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 18	1 21	1 25	1 29	1 34	1 39	1 45	1 51	1 59	2 07	2 18	2 30	4
8	5 11	5 25	5 40	5 57	6 16	6 37	7 01	7 26	7 57	8 31	9 11	10 00	8
12	11 40	12 12	12 46	13 24	14 07	14 53	15 46	16 46	17 53	19 11	20 41	22 29	12
16	20 44	21 40	22 42	23 48	25 05	26 27	28 02	29 46	31 47	34 05	36 47	39 59	16
20	32 24	33 52	35 28	37 12	39 12	41 20	43 48	46 32	49 40	53 16	57 28	62-28	20
24	46 40	48 46	51 05	53 34	56 27	59 31	63 04	...	...	...	...	...	24
28	63 30	66 23	69 31	72 53	76 50	81 01	...	...	...	...	...	...	28
32	82 56	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	4.86	5.08	5.32	5.58	5.88	6.20	6.57	6.98	7.45	7.99	8.62	9.37	$\triangle_1$h
Log.	0.686 64	0.705 86	0.725 91	0.746 63	0.769 38	0.792 39	0.817 57	0.843 86	0.872 16	0.902 55	0.935 51	0.971 74	Log.
Limit	26	25	24	23	22	21	20	19	18	17	16	15	Minutes
Meridian	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 44	3 02	3 23	3 50	4 28	5 19	...	...	...	...	...	...	4
8	10 56	12 06	13 32	15 24	17 52	21 18	...	...	...	...	...	...	8
12	24 36	27 13	30 27	34 38	40 11	...	...	...	...	...	...	...	12
16	43 44	48 23	54 08	61 34	...	...	...	...	...	...	...	...	16
20	68 20	75 36	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	10.25	11.34	12.69	14.43	16.74	19.98	...	...	...	...	...	...	$\triangle_1$h
Log.	1.010 72	1.054 61	1.103 46	1.159 27	1.223 76	1.300 60	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	14	13	12	11	10	9	8	6	3	1	0	2	Minutes
Meridian	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	4 58	4 06	3 29	3 01	2 39	2 22	2 08	1 56	1 46	4
8	...	...	...	19 51	16 24	13 57	12 05	10 38	9 29	8 32	7 45	7 04	8
12	...	...	...	...	36 55	31 22	27 11	23 58	21 20	19 12	17 26	15 54	12
16	...	...	...	...	...	55 46	48 21	42 34	37 56	34 08	30 58	28 18	16
20	...	...	...	...	...	...	...	...	...	53 20	48 24	44 12	20
24	...	...	...	...	...	...	...	...	...	...	...	63 39	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	18.61	15.38	13.07	11.33	9.98	8.89	8.00	7.26	6.63	$\triangle_1 h$
Log.	... ...	... ...	... ...	1.269 75	1.186 96	1.116 28	1.054 23	0.999 13	0.948 90	0.903 09	0.860 94	0.821 51	Log.
Limit	4	5	6	7	9	11	12	14	15	17	19	20	Minutes
Meridian	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 37	1 30	1 23	1 18	1 12	1 07	1 03	0 59	0 56	0 52	0 50	0 47	4
8	6 30	5 59	5 33	5 10	4 49	4 30	4 13	3 59	3 44	3 31	3 19	3 08	8
12	14 37	13 29	12 29	11 37	10 49	10 08	9 31	8 56	8 24	7 54	7 27	7 04	12
16	25 59	23 59	22 11	20 39	19 15	18 00	16 53	15 52	14 56	14 02	13 17	12 32	16
20	40 36	37 28	34 40	32 16	30 04	28 08	26 24	24 48	23 20	21 56	20 44	19 36	20
24	58 28	53 58	49 55	46 28	43 18	40 31	38 01	35 43	33 36	31 35	29 52	28 13	24
28	79 35	73 26	67 57	63 14	58 56	55 09	51 45	48 37	45 44	43 00	40 38	38 25	28
32	...	...	...	82 36	76 58	72 01	67 35	63 29	59 44	56 09	53 04	50 11	32
36	...	...	...	...	...	...	...	...	75 36	71 04	67 11	63 30	36
40	...	...	...	...	...	...	...	...	...	87 44	82 56	78 24	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.09	5.62	5.20	4.84	4.51	4.22	3.96	3.72	3.50	3.29	3.11	2.94	$\triangle_1 h$
Log.	0.784 62	0.749 74	0.716 00	0.684 85	0.654 18	0.625 31	0.597 70	0.570 54	0.544 07	0.517 20	0.492 76	0.468 35	Log.
Limit	22	24	25	26	27	28	29	30	31	33	34	35	Minutes
Meridian	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	Altitudes

Latitude 22° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 44	0 42	0 39	0 38	0 36	0 34	0 32	0 30	0 29	0 27	0 27	0 25	4
8	2 58	2 48	2 40	2 31	2 24	2 16	2 09	2 02	1 56	1 51	1 45	1 40	8
12	6 41	6 18	5 59	5 40	5 23	5 06	4 51	4 37	4 22	4 09	3 56	3 45	12
16	11 51	11 14	10 37	10 04	9 33	9 06	8 37	8 11	7 46	7 23	7 00	6 39	16
20	18 32	17 32	16 36	15 44	14 56	14 12	13 28	12 48	12 08	11 32	10 56	10 24	20
24	26 41	25 15	23 54	22 40	21 30	20 27	19 24	18 26	17 29	16 36	15 45	14 59	24
28	36 20	34 22	32 33	30 50	29 16	27 50	26 24	25 06	23 47	22 37	21 25	20 23	28
32	47 27	44 53	42 30	40 16	38 14	36 21	34 28	32 46	31 03	29 32	27 59	26 37	32
36	60 03	56 49	53 47	50 59	48 23	46 01	43 38	41 28	39 19	37 22	35 26	33 42	36
40	74 08	70 08	66 24	62 56	59 44	56 48	53 52	51 12	48 32	46 08	43 44	41 36	40
44	...	84 52	80 20	76 09	72 16	68 44	65 11	61 57	58 44	55 49	52 55	50 20	44
48	...	...	95 37	90 37	86 01	81 46	77 34	73 44	69 53	66 24	62 58	59 54	48
52	...	...	...	106 21	100 57	95 59	91 02	86 32	82 01	77 58	73 54	70 18	52
56	...	...	...	...	...	...	105 35	100 21	95 08	90 25	85 43	81 32	56
60	...	...	...	...	...	...	...	...	109 12	103 48	98 24	93 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.78	2.63	2.49	2.36	2.24	2.13	2.02	1.92	1.82	1.73	1.64	1.56	$\Delta_1 h$
Log.	0.444 04	0.419 96	0.396 20	0.372 91	0.350 25	0.328 38	0.305 35	0.283 30	0.260 07	0.238 05	0.214 84	0.193 12	Log.
Limit	36	37	38	39	41	43	44	45	45	47	49	51	Minutes
Meridian	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 22	0 21	0 20	0 19	0 18	0 17	0 16	0 15	0 14	0 13	0 12	4
8	1 35	1 30	1 25	1 21	1 16	1 12	1 08	1 04	1 01	0 57	0 54	0 51	8
12	3 34	3 22	3 11	3 02	2 51	2 42	2 34	2 25	2 17	2 08	2 01	1 54	12
16	6 18	5 58	5 41	5 22	5 05	4 50	4 34	4 19	4 03	3 48	3 35	3 22	16
20	9 52	9 20	8 52	8 24	7 56	7 32	7 08	6 44	6 20	5 56	5 36	5 16	20
24	14 12	13 26	12 46	12 06	11 26	10 51	10 16	9 42	9 07	8 33	8 04	7 35	24
28	19 21	18 18	17 23	16 28	15 33	14 46	13 59	13 12	12 25	11 38	10 58	10 20	28
32	25 16	23 54	22 42	21 30	20 18	19 17	18 16	17 14	16 13	15 11	14 20	13 29	32
36	31 58	30 14	28 44	27 13	25 43	24 25	23 07	21 49	20 31	19 14	18 09	17 04	36
40	39 28	37 20	35 28	33 36	31 44	30 08	28 32	26 56	25 20	23 44	22 24	21 04	40
44	47 45	45 10	42 55	40 39	38 24	36 28	34 32	32 35	30 39	28 43	27 06	25 29	44
48	56 50	53 46	51 04	48 23	45 41	43 23	41 05	38 47	36 29	34 10	32 15	30 18	48
52	66 42	63 06	59 56	56 47	53 37	50 55	48 13	45 31	42 49	40 06	37 51	35 36	52
56	77 21	73 10	69 31	65 51	62 12	59 04	55 56	52 47	49 39	46 31	43 54	41 17	56
60	88 48	84 00	79 48	75 36	71 24	67 48	64 12	60 36	57 00	53 24	50 24	47 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.48	1.40	1.33	1.26	1.19	1.13	1.07	1.01	0.95	0.89	0.84	0.79	$\Delta_1 h$
Log.	0.170 26	0.146 13	0.123 85	0.100 37	0.075 55	0.053 08	0.029 38	0.004 32	9.977 72	9.949 39	9.924 28	9.897 63	Log.
Limit	53	55	57	59	61	62	63	65	67	69	71	73	Minutes
Meridian	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	Altitudes

Latitude 22° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 18	1 15	1 11	1 09	1 07	1 03	1 02	0 59	0 58	0 55	0 54	0 52	4
8	5 11	4 58	4 47	4 35	4 25	4 15	4 07	4 00	3 51	3 44	3 36	3 30	8
12	11 40	11 11	10 44	10 19	9 56	9 35	9 16	8 57	8 39	8 23	8 07	7 53	12
16	20 44	19 53	19 04	18 21	17 40	17 01	16 28	15 55	15 25	14 53	14 25	13 59	16
20	32 24	31 04	29 48	28 40	27 36	26 36	25 44	24 52	24 04	23 16	22 32	21 52	20
24	46 40	44 45	42 53	41 17	39 45	38 18	37 04	35 48	34 40	33 30	32 27	31 29	24
28	63 30	60 53	58 25	56 11	54 05	52 09	50 26	48 45	47 10	45 37	44 10	42 52	28
32	82 56	79 31	76 18	73 23	70 39	68 06	65 52	63 40	61 36	59 34	57 41	55 59	32
36	...	...	...	...	...	...	...	...	77 59	75 23	73 01	70 51	36
40	...	...	...	...	...	...	...	...	...	...	90 08	87 28	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.86	4.66	4.47	4.30	4.14	3.99	3.86	3.73	3.61	3.49	3.38	3.28	$\triangle_1 h$
Log.	0.686 64	0.668 39	0.650 31	0.633 47	0.617 00	0.600 97	0.586 59	0.571 71	0.557 51	0.542 83	0.528 92	0.515 87	Log.
Limit	26	27	28	29	30	30	30	31	32	32	33	34	Minutes
Meridian	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 51	0 49	0 48	0 46	0 46	0 44	0 43	0 42	0 41	0 39	0 38	0 38	4
8	3 23	3 18	3 13	3 06	3 02	2 58	2 52	2 47	2 44	2 40	2 36	2 32	8
12	7 38	7 25	7 13	7 01	6 49	6 39	6 27	6 17	6 09	5 59	5 50	5 41	12
16	13 34	13 11	12 51	12 27	12 07	11 49	11 29	11 11	10 55	10 37	10 22	10 07	16
20	21 12	20 36	20 04	19 28	18 56	18 28	17 56	17 28	17 04	16 36	16 12	15 48	20
24	30 32	29 40	28 54	28 02	27 16	26 35	25 50	25 10	24 35	23 54	23 19	22 45	24
28	41 33	40 23	39 20	38 10	37 06	36 12	35 09	34 14	33 27	32 33	31 46	30 58	28
32	54 16	52 44	51 22	49 50	48 28	47 17	45 54	44 42	43 41	42 30	41 29	40 27	32
36	68 42	66 45	65 01	63 04	61 21	59 50	58 07	56 36	55 18	53 47	52 29	51 12	36
40	84 48	82 24	80 16	77 52	75 44	73 52	71 44	69 52	68 16	66 24	64 48	63 12	40
44	...	...	...	...	...	...	86 48	84 33	82 36	80 20	78 24	76 39	44
48	...	...	...	...	...	...	...	...	...	95 37	93 19	91 00	48
52	...	...	...	...	...	...	...	...	...	...	...	106 48	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.18	3.09	3.01	2.92	2.84	2.77	2.69	2.62	2.56	2.49	2.43	2.37	$\triangle_1 h$
Log.	0.502 43	0.489 96	0.478 57	0.465 38	0.453 32	0.442 48	0.429 75	0.418 30	0.408 24	0.396 20	0.385 61	0.374 75	Log.
Limit	35	35	36	37	38	39	40	40	41	42	43	44	Minutes
Meridian	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	Altitudes

Latitude 22° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 37	0 36	0 35	0 35	0 34	0 33	0 32	0 31	0 30	0 30	0 29	0 28	4
8	2 28	2 25	2 21	2 17	2 14	2 11	2 08	2 04	2 02	1 59	1 56	1 54	8
12	5 32	5 26	5 17	5 09	5 02	4 55	4 48	4 41	4 35	4 28	4 22	4 17	12
16	9 52	9 38	9 23	9 11	8 58	8 45	8 32	8 19	8 09	7 56	7 46	7 35	16
20	15 24	15 04	14 40	14 20	14 00	13 40	13 20	13 00	12 44	12 24	12 08	11 52	20
24	22 11	21 42	21 07	20 39	20 10	19 41	19 12	18 43	18 20	17 52	17 29	17 05	24
28	30 11	29 32	28 45	28 05	27 26	26 47	26 08	25 29	24 58	24 18	23 47	23 16	28
32	39 25	38 34	37 33	36 41	35 50	34 59	34 08	33 17	32 36	31 44	31 03	30 23	32
36	49 54	48 49	47 31	46 27	45 22	44 17	43 12	42 07	41 15	40 11	39 19	38 27	36
40	61 36	60 16	58 40	57 20	56 00	54 40	53 20	52 00	50 56	49 36	48 32	47 28	40
44	74 32	72 55	70 59	69 23	67 46	66 09	64 32	62 55	61 37	60 01	58 44	57 26	44
48	88 42	86 47	84 29	82 33	80 38	78 43	76 48	74 53	73 21	71 25	69 53	68 19	48
52	104 06	101 51	99 09	96 53	94 38	92 23	90 08	87 53	86 05	83 49	82 01	80 13	52
56	...	...	...	...	...	...	...	101 55	99 49	97 13	95 08	93 02	56
60	...	...	...	...	...	...	...	...	...	...	109 12	106 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.31	2.26	2.20	2.15	2.10	2.05	2.00	1.95	1.91	1.86	1.82	1.78	$\triangle_1 h$
Log.	0.363 61	0.354 11	0.342 42	0.332 44	0.322 22	0.311 75	0.301 03	0.290 03	0.281 03	0.269 51	0.260 07	0.250 42	Log.
Limit	45	46	47	48	48	49	50	50	51	52	53	54	Minutes
Meridian	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 27	0 27	0 26	0 25	0 25	0 24	0 23	0 22	0 22	0 22	0 21	4
8	1 52	1 49	1 46	1 43	1 41	1 39	1 36	1 35	1 32	1 30	1 27	1 25	8
12	4 11	4 05	3 59	3 53	3 48	3 42	3 36	3 32	3 24	3 22	3 16	3 11	12
16	7 25	7 15	7 05	6 55	6 44	6 34	6 24	6 16	6 06	5 58	5 48	5 41	16
20	11 36	11 20	11 04	10 48	10 32	10 16	10 00	9 48	9 32	9 20	9 04	8 52	20
24	16 42	16 19	15 57	15 34	15 10	14 47	14 24	14 06	13 43	13 26	13 04	12 46	24
28	22 44	22 13	21 41	21 10	20 39	20 07	19 36	19 13	18 42	18 18	17 46	17 23	28
32	29 42	29 01	28 19	27 38	26 58	26 17	25 36	25 06	24 25	23 54	23 12	22 42	32
36	37 35	36 43	35 52	35 00	34 08	33 16	32 24	31 45	30 53	30 14	29 23	28 44	36
40	46 24	45 20	44 16	43 12	42 08	41 04	40 00	39 12	38 08	37 20	36 16	35 28	40
44	56 08	54 51	53 34	52 17	50 59	49 41	48 24	47 26	46 08	45 10	43 53	42 55	44
48	66 47	65 15	63 44	62 12	60 40	59 08	57 36	56 27	54 55	53 46	52 13	51 04	48
52	78 25	76 37	74 48	73 00	71 12	69 24	67 36	66 15	64 27	63 06	61 17	59 56	52
56	90 56	88 51	86 46	84 41	82 35	80 29	78 24	76 50	74 44	73 10	71 05	69 31	56
60	...	102 00	99 36	97 12	94 48	92 24	90 00	88 12	85 48	84 00	81 36	79 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.74	1.70	1.66	1.62	1.58	1.54	1.50	1.47	1.43	1.40	1.36	1.33	$\triangle_1 h$
Log.	0.240 55	0.230 45	0.220 11	0.209 52	0.198 66	0.187 52	0.176 09	0.167 32	0.155 34	0.146 13	0.133 54	0.123 85	Log.
Limit	55	56	57	58	59	60	61	62	63	64	65	66	Minutes
Meridian	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 21	0 20	0 19	0 19	0 19	0 18	0 18	0 17	0 17	0 16	0 15	0 15	4
8	1 23	1 21	1 19	1 17	1 15	1 12	1 10	1 08	1 07	1 04	1 02	1 01	8
12	3 07	3 02	2 57	2 53	2 48	2 42	2 38	2 34	2 30	2 25	2 22	2 17	12
16	5 33	5 22	5 15	5 07	5 00	4 50	4 42	4 34	4 26	4 19	4 10	4 03	16
20	8 40	8 24	8 12	8 00	7 48	7 32	7 20	7 08	6 56	6 44	6 32	6 20	20
24	12 29	12 06	11 48	11 31	11 14	10 51	10 34	10 16	9 59	9 42	9 24	9 07	24
28	16 59	16 28	16 05	15 41	15 17	14 46	14 22	13 59	13 35	13 12	12 49	12 25	28
32	22 11	21 30	21 00	20 29	19 58	19 17	18 46	18 16	17 45	17 14	16 44	16 13	32
36	28 05	27 13	26 34	25 55	25 17	24 25	23 46	23 07	22 28	21 49	21 10	20 31	36
40	34 40	33 36	32 48	32 00	31 12	30 08	29 20	28 32	27 44	26 56	26 08	25 20	40
44	41 57	40 39	39 41	38 43	37 46	36 28	35 30	34 32	33 33	32 35	31 27	30 39	44
48	49 55	48 23	47 14	46 05	44 55	43 23	42 14	41 05	39 56	38 47	37 38	36 29	48
52	58 35	56 47	55 26	54 05	52 43	50 55	49 34	48 13	46 52	45 31	44 10	42 49	52
56	67 57	65 51	64 17	62 43	61 10	59 04	57 30	55 56	54 21	52 47	51 13	49 39	56
60	78 00	75 36	73 48	72 00	70 12	67 48	66 00	64 12	62 24	60 36	58 48	57 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.30	1.26	1.23	1.20	1.17	1.13	1.10	1.07	1.04	1.01	0.98	0.95	$\triangle_1$h
Log.	0.113 94	0.100 37	0.089 91	0.079 18	0.068 19	0.053 08	0.041 39	0.029 38	0.017 03	0.004 32	9.991 23	9.977 72	Log.
Limit	68	69	71	72	73	74	76	77	78	79	80	81	Minutes
Meridian	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°		Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	0 14	0 13	0 13	...	...	...	...	...	...	...	4
8	0 58	0 57	0 55	0 53	0 51	...	...	...	...	...	...	...	8
12	2 13	2 08	2 04	1 59	1 55	...	...	...	...	...	...	...	12
16	3 55	3 48	3 40	3 33	3 25	...	...	...	...	...	...	...	16
20	6 08	5 56	5 44	5 32	5 20	...	...	...	...	...	...	...	20
24	8 50	8 33	8 16	7 58	7 41	...	...	...	...	...	...	...	24
28	12 02	11 38	11 14	10 51	10 27	...	...	...	...	...	...	...	28
32	15 42	15 11	14 40	14 10	13 39	...	...	...	...	...	...	...	32
36	19 52	19 14	18 35	17 56	17 17	...	...	...	...	...	...	...	36
40	24 32	23 44	25 56	22 08	21 20	...	...	...	...	...	...	...	40
44	29 41	28 43	27 45	26 47	25 49	...	...	...	...	...	...	...	44
48	35 20	34 10	33 01	31 52	30 43	...	...	...	...	...	...	...	48
52	41 28	40 06	38 45	37 24	36 03	...	...	...	...	...	...	...	52
56	48 05	46 31	44 57	43 23	41 49	...	...	...	...	...	...	...	56
60	55 12	53 24	51 36	49 48	48 00	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.92	0.89	0.86	0.83	0.80	...	...	...	...	...	...	...	$\triangle_1$h
Log.	9.963 79	9.949 39	9.934 50	9.919 08	9.903 09	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	82	83	84	85	86								Minutes
Meridian	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	Altitudes

Latitude 23° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 14	1 17	1 21	1 24	1 29	1 33	1 39	1 44	1 50	1 58	2 06	2 16	4
8	4 56	5 08	5 23	5 38	5 55	6 13	6 33	6 57	7 22	7 52	8 26	9 06	8
12	11 06	11 34	12 06	12 41	13 18	13 59	14 45	15 37	16 37	17 43	18 58	20 28	12
16	19 46	20 34	21 30	22 31	23 38	24 53	26 15	27 47	29 31	31 29	33 45	36 24	16
20	30 52	32 08	33 36	35 12	36 56	38 52	41 00	43 24	46 08	49 12	52 44	56 52	20
24	44 27	46 17	48 23	50 41	53 11	55 58	59 03	62 30	66 26	...	...	...	24
28	60 30	62 59	65 51	69 00	72 23	76 11	80 21	...	...	...	...	...	28
32	79 01	82 15	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.63	4.82	5.04	5.28	5.54	5.83	6.15	6.51	6.92	7.38	7.91	8.53	$\triangle_1 h$
Log.	0.665 58	0.683 05	0.702 43	0.722 63	0.743 51	0.765 67	0.788 88	0.813 58	0.840 11	0.868 06	0.898 18	0.930 95	Log.
Limit	27	26	25	24	23	22	21	20	19	18	17	16	Minutes
Meridian	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 28	2 42	2 59	3 21	3 48	4 25	5 15	...	...	...	...	...	4
8	9 54	10 49	11 58	13 23	15 13	17 39	21 02	...	...	...	...	...	8
12	22 15	24 20	26 54	30 06	34 14	39 42	...	...	...	...	...	...	12
16	39 33	43 16	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	9.27	10.14	11.21	12.54	14.26	16.54	19.72	...	...	...	...	...	$\triangle_1 h$
Log.	0.967 08	1.006 04	1.049 61	1.098 30	1.154 12	1.218 54	1.294 91	... ...	... ...	... ...	... ...	... ...	Log.
Limit	15	14	13	12	11	10	9	8	5	3	1	0	Minutes
Meridian	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	4 53	4 02	3 26	2 58	2 37	2 20	2 06	1 54	4
8	...	...	...	...	19 32	16 07	13 42	11 52	10 27	9 19	8 23	7 36	8
12	...	...	...	...	...	36 17	30 49	26 42	23 31	20 57	18 51	17 05	12
16	...	...	...	...	...	...	...	47 30	41 49	37 15	33 30	30 23	16
20	...	...	...	...	...	...	...	...	...	58 12	52 20	47 28	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	18.31	15.12	12.84	11.13	9.80	8.73	7.85	7.12	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	1.262 69	1.179 55	1.108 57	1.046 50	0.991 23	0.941 01	0.894 87	0.852 48	Log.
Limit	2	4	5	6	7	9	11	13	14	15	17	19	Minutes
Meridian	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 44	1 36	1 28	1 22	1 16	1 10	1 06	1 02	0 58	0 55	0 51	0 48	4
8	6 56	6 22	5 52	5 26	5 04	4 43	4 24	4 07	3 52	3 38	3 26	3 14	8
12	15 36	14 20	13 12	12 14	11 23	10 36	9 54	9 16	8 42	8 11	7 43	7 16	12
16	27 44	25 27	23 28	21 45	20 13	18 50	17 38	16 29	15 30	14 33	13 42	12 55	16
20	43 20	39 48	36 40	34 00	31 36	29 25	27 32	25 45	24 12	22 44	21 24	20 12	20
24	62 24	57 18	52 48	48 58	45 30	42 20	39 39	37 04	34 51	32 44	30 49	29 04	24
28	...	78 01	71 52	66 38	61 54	57 38	53 58	50 26	47 26	44 34	41 57	39 36	28
32	...	...	...	...	80 54	75 16	70 29	65 52	61 57	58 12	54 47	51 43	32
36	...	...	...	...	...	...	...	...	78 25	73 39	69 20	65 27	36
40	...	...	...	...	...	...	...	...	...	...	85 36	80 48	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.50	5.97	5.50	5.10	4.74	4.41	4.13	3.86	3.63	3.41	3.21	3.03	$\triangle_1 h$
Log.	0.812 91	0.775 97	0.740 36	0.707 57	0.675 78	0.644 44	0.615 95	0.586 59	0.559 91	0.532 75	0.506 51	0.481 44	Log.
Limit	21	23	24	25	26	27	28	29	30	32	33	34	Minutes
Meridian	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 46	0 43	0 41	0 39	0 37	0 35	0 33	0 31	0 30	0 28	0 27	0 25	4
8	3 03	2 53	2 44	2 35	2 27	2 19	2 12	2 05	1 59	1 53	1 47	1 41	8
12	6 52	6 29	6 08	5 49	5 31	5 14	4 57	4 43	4 28	4 14	4 00	3 48	12
16	12 13	11 32	10 55	10 20	9 49	9 18	8 47	8 21	7 56	7 30	7 08	6 44	16
20	19 04	18 01	17 03	16 09	15 20	14 32	13 44	13 04	12 24	11 44	11 08	10 32	20
24	27 27	25 57	24 35	23 14	22 05	20 56	19 47	18 49	17 52	16 54	16 02	15 10	24
28	37 22	35 18	33 27	31 38	30 03	28 29	26 55	25 37	24 18	23 00	21 49	20 39	28
32	48 48	46 05	43 41	41 17	39 15	37 12	35 09	33 27	31 44	30 02	28 30	26 58	32
36	61 47	58 19	55 18	52 16	49 41	47 06	44 30	42 20	40 11	38 01	36 05	34 08	36
40	76 16	72 00	68 16	64 32	61 20	58 08	54 56	52 16	49 36	46 56	44 32	42 08	40
44	...	87 07	82 36	78 05	74 13	70 21	66 28	63 14	60 01	56 47	53 54	50 59	44
48	...	...	...	92 56	88 19	83 42	79 06	75 16	71 25	67 33	64 07	60 40	48
52	...	...	...	...	...	...	92 50	88 20	83 49	79 19	75 15	71 12	52
56	...	...	...	...	...	...	...	...	97 13	91 59	87 18	82 35	56
60	...	...	...	...	...	...	...	...	...	...	...	94 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.86	2.70	2.56	2.42	2.30	2.18	2.06	1.96	1.86	1.76	1.67	1.58	$\triangle_1$h
Log.	0.456 37	0.431 36	0.408 24	0.383 82	0.361 73	0.338 46	0.313 87	0.292 26	0.269 51	0.245 51	0.222 72	0.198 66	Log.
Limit	35	36	37	39	40	41	43	44	45	46	48	50	Minutes
Meridian	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 24	0 22	0 22	0 20	0 19	0 19	0 17	0 16	0 15	0 14	0 14	0 12	4
8	1 36	1 31	1 26	1 22	1 17	1 13	1 09	1 05	1 01	0 57	0 54	0 50	8
12	3 36	3 25	3 14	3 05	2 54	2 44	2 36	2 27	2 19	2 10	2 01	1 52	12
16	6 24	6 03	5 46	5 27	5 10	4 52	4 36	4 21	4 05	3 50	3 35	3 19	16
20	10 00	9 28	9 00	8 32	8 04	7 36	7 12	6 48	6 24	6 00	5 36	5 12	20
24	14 24	13 38	12 58	12 17	11 37	10 57	10 22	9 48	9 13	8 38	8 04	7 29	24
28	19 36	18 34	17 38	16 44	15 49	14 53	14 07	13 20	12 33	11 46	10 58	10 12	28
32	25 36	24 14	23 02	21 51	20 39	19 27	18 26	17 24	16 23	15 22	14 20	13 19	32
36	32 24	30 40	29 10	27 39	26 08	24 38	23 20	22 02	20 44	19 26	18 09	16 51	36
40	40 00	37 52	36 00	34 08	32 16	30 24	28 48	27 12	25 36	24 00	22 24	20 48	40
44	48 24	45 49	43 34	41 18	39 02	36 47	34 51	32 55	30 58	29 02	27 06	25 10	44
48	57 36	54 32	51 50	49 09	46 28	43 46	41 28	39 10	36 52	34 34	32 15	29 55	48
52	67 36	64 00	60 50	57 41	54 32	51 22	48 40	45 58	43 16	40 34	37 51	35 09	52
56	78 24	74 13	70 34	66 54	63 14	59 35	56 27	53 19	50 10	47 02	43 54	40 46	56
60	90 00	85 12	81 00	76 48	72 36	68 24	64 48	61 12	57 36	54 00	50 24	46 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.50	1.42	1.35	1.28	1.21	1.14	1.08	1.02	0.96	0.90	0.84	0.78	$\triangle_1$h
Log.	0.176 09	0.152 29	0.130 33	0.107 21	0.082 79	0.056 90	0.033 42	0.008 60	9.982 27	9.954 24	9.924 28	9.892 09	Log.
Limit	52	54	56	58	60	61	62	64	66	68	70	72	Minutes
Meridian	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 14	1 11	1 08	1 06	1 03	1 02	0 59	0 57	0 55	0 54	0 52	0 51	4
8	4 56	4 45	4 34	4 23	4 14	4 06	3 58	3 50	3 43	3 36	3 30	3 23	8
12	11 06	10 40	10 15	9 53	9 32	9 13	8 54	8 37	8 22	8 05	7 51	7 36	12
16	19 46	18 56	18 13	17 35	16 56	16 23	15 50	15 19	14 50	14 23	13 57	13 32	16
20	30 52	29 36	28 28	27 28	26 28	25 36	24 44	23 56	23 12	22 28	21 48	21 08	20
24	44 27	42 37	40 59	39 34	38 06	36 52	35 37	34 28	33 24	32 21	31 23	30 26	24
28	60 30	58 01	55 48	53 50	51 53	50 10	48 29	46 55	45 29	44 02	42 44	41 25	28
32	79 01	75 47	72 53	70 18	67 46	65 32	63 19	61 16	59 24	57 31	55 49	54 06	32
36	...	...	...	...	...	...	80 08	77 33	75 10	72 48	70 38	68 29	36
40	...	...	...	...	...	...	...	...	...	89 52	87 12	84 32	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.63	4.44	4.27	4.12	3.97	3.84	3.71	3.59	3.48	3.37	3.27	3.17	$\triangle_1 h$
Log.	0.665 58	0.647 38	0.630 43	0.614 90	0.598 79	0.584 33	0.569 37	0.555 09	0.541 58	0.527 63	0.514 55	0.501 06	Log.
Limit	27	28	29	30	31	31	32	32	33	34	34	35	Minutes
Meridian	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 49	0 48	0 46	0 46	0 44	0 43	0 42	0 41	0 39	0 38	0 38	0 37	4
8	3 17	3 12	3 06	3 02	2 57	2 52	2 47	2 43	2 40	2 36	2 32	2 28	8
12	7 24	7 12	6 59	6 49	6 38	6 27	6 17	6 07	5 59	5 50	5 41	5 32	12
16	13 08	12 48	12 25	12 07	11 46	11 29	11 11	10 53	10 37	10 22	10 07	9 52	16
20	20 32	20 00	19 24	18 56	18 24	17 56	17 28	17 00	16 36	16 12	15 48	15 24	20
24	29 34	28 48	27 56	27 16	26 30	25 50	25 10	24 29	23 54	23 19	22 45	22 11	24
28	40 15	39 12	38 02	37 06	36 04	35 09	34 14	33 19	32 33	31 46	30 58	30 11	28
32	52 34	51 12	49 40	48 28	47 06	45 54	44 42	43 31	42 30	41 29	40 27	39 25	32
36	66 32	64 48	62 51	61 21	59 37	58 07	56 36	55 05	53 47	52 29	51 12	49 54	36
40	82 08	80 00	77 36	75 44	73 36	71 44	69 52	68 00	66 24	64 48	63 12	61 36	40
44	...	...	...	...	...	86 48	84 33	82 17	80 20	78 24	76 39	74 32	44
48	...	...	...	...	...	...	...	...	95 37	93 19	91 00	88 42	48
52	...	...	...	...	...	...	...	...	...	...	106 48	104 06	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.08	3.00	2.91	2.84	2.76	2.69	2.62	2.55	2.49	2.43	2.37	2.31	$\triangle_1 h$
Log.	0.488 55	0.477 12	0.463 89	0.453 32	0.440 91	0.429 75	0.418 30	0.406 54	0.396 20	0.385 61	0.374 75	0.363 61	Log.
Limit	36	36	37	38	39	39	40	41	42	43	44	45	Minutes
Meridian	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	Altitudes

Latitude 23° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 36	0 35	0 35	0 34	0 33	0 32	0 31	0 30	0 30	0 30	0 28	0 27	4
8	2 25	2 21	2 17	2 14	2 11	2 09	2 05	2 02	2 00	1 57	1 54	1 52	8
12	5 26	5 17	5 09	5 02	4 55	4 49	4 43	4 35	4 29	4 23	4 17	4 12	12
16	9 38	9 23	9 11	8 58	8 45	8 35	8 21	8 09	7 59	7 49	7 35	7 28	16
20	15 04	14 40	14 20	14 00	13 40	13 24	13 04	12 44	12 28	12 12	11 52	11 40	20
24	21 42	21 07	20 39	20 10	19 41	19 18	18 49	18 20	17 57	17 34	17 05	16 48	24
28	29 32	28 45	28 05	27 26	26 47	26 16	25 37	24 58	24 26	23 55	23 16	22 52	28
32	38 34	37 33	36 41	35 50	34 59	34 18	33 27	32 36	31 55	31 14	30 23	29 52	32
36	48 49	47 31	46 27	45 22	44 17	43 25	42 20	41 15	40 24	39 32	38 27	37 48	36
40	60 16	58 40	57 20	56 00	54 40	53 36	52 16	50 56	49 52	48 48	47 28	46 40	40
44	72 55	70 59	69 23	67 46	66 09	64 51	63 14	61 37	60 21	59 03	57 26	56 28	44
48	86 47	84 29	82 33	80 38	78 43	77 11	75 16	73 21	71 48	70 16	68 19	67 10	48
52	101 51	99 09	96 53	94 38	92 23	90 35	88 20	86 05	84 16	82 28	80 13	78 52	52
56	...	...	...	109 46	107 09	105 03	102 26	99 49	97 45	95 39	93 02	91 28	56
60	...	...	...	...	...	...	117 36	114 36	112 12	109 48	106 48	105 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.26	2.20	2.15	2.10	2.05	2.01	1.96	1.91	1.87	1.83	1.78	1.75	$\triangle_1$h
Log.	0.354 11	0.342 42	0.332 44	0.322 22	0.311 75	0.303 20	0.292 26	0.281 03	0.271 84	0.262 45	0.250 42	0.243 04	Log.
Limit	46	47	48	49	50	50	51	51	52	53	54	55	Minutes
Meridian	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 26	0 25	0 25	0 24	0 23	0 23	0 22	0 22	0 22	0 21	4
8	1 50	1 47	1 44	1 42	1 39	1 37	1 35	1 33	1 31	1 28	1 26	1 24	8
12	4 06	4 00	3 54	3 49	3 43	3 37	3 34	3 28	3 23	3 19	3 13	3 08	12
16	7 18	7 08	6 58	6 47	6 37	6 27	6 18	6 08	6 01	5 53	5 43	5 36	16
20	11 24	11 08	10 52	10 36	10 20	10 04	9 52	9 36	9 24	9 12	8 56	8 44	20
24	16 25	16 02	15 39	15 16	14 53	14 30	14 12	13 49	13 32	13 15	12 52	12 35	24
28	22 21	21 49	21 18	20 47	20 15	19 44	19 21	18 49	18 26	18 02	17 30	17 07	28
32	29 11	28 30	27 49	27 08	26 27	25 46	25 16	24 35	24 04	23 33	22 52	22 21	32
36	36 56	36 05	35 13	34 21	33 29	32 37	31 58	31 06	30 27	29 49	28 57	28 18	36
40	45 36	44 32	43 28	42 24	41 20	40 16	39 28	38 24	37 36	36 48	35 44	34 56	40
44	55 10	53 54	52 36	51 18	50 01	48 43	47 45	46 27	45 29	44 32	43 14	42 16	44
48	65 38	64 07	62 35	61 03	59 31	57 59	56 50	55 18	54 09	52 59	51 27	50 18	48
52	77 04	75 15	73 27	71 39	69 51	68 03	66 42	64 54	63 33	62 11	60 23	59 02	52
56	89 22	87 18	85 12	83 06	81 01	78 55	77 21	75 15	73 41	72 08	70 02	68 28	56
60	102 36	100 12	97 48	95 24	93 00	90 36	88 48	86 24	84 36	82 48	80 24	78 26	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.71	1.67	1.63	1.59	1.55	1.51	1.48	1.44	1.41	1.38	1.34	1.31	$\triangle_1$h
Log.	0.233 00	0.222 72	0.212 19	0.201 40	0.190 33	0.178 98	0.170 26	0.158 36	0.149 22	0.139 88	0.127 10	0.117 27	Log.
Limit	55	56	57	58	59	60	61	62	63	64	65	66	Minutes
Meridian	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	0 20	0 20	0 19	0 19	0 18	0 17	0 17	0 17	0 16	0 16	0 15	0 15	4
8	1 22	1 20	1 18	1 15	1 13	1 11	1 10	1 08	1 05	1 04	1 02	1 00	8
12	3 05	3 00	2 54	2 50	2 45	2 41	2 37	2 33	2 28	2 24	2 20	2 16	12
16	5 27	5 20	5 10	5 02	4 55	4 47	4 39	4 31	4 24	4 16	4 08	4 00	16
20	8 32	8 20	8 04	7 52	7 40	7 28	7 16	7 04	6 52	6 40	6 28	6 16	20
24	12 17	12 00	11 37	11 20	11 03	10 46	10 28	10 11	9 53	9 36	9 18	9 01	24
28	16 44	16 20	15 49	15 25	15 01	14 38	14 15	13 51	13 28	13 04	12 41	12 17	28
32	21 51	21 20	20 39	20 08	19 37	19 06	18 36	18 05	17 35	17 04	16 34	16 03	32
36	27 39	27 00	26 08	25 30	24 51	24 12	23 33	22 54	22 15	21 36	20 57	20 18	36
40	34 08	33 20	32 16	31 28	30 40	29 52	29 04	28 16	27 28	26 40	25 52	25 04	40
44	41 18	40 20	39 02	38 05	37 07	36 09	35 10	34 12	33 14	32 16	31 18	30 19	44
48	49 09	48 00	46 28	45 18	44 08	43 00	41 51	40 42	39 33	38 24	37 15	36 06	48
52	57 41	56 20	54 32	53 10	51 49	50 28	49 07	47 46	46 25	45 04	43 43	42 22	52
56	66 54	65 20	63 14	61 41	60 07	58 33	56 58	55 24	53 50	52 16	50 42	49 07	56
60	76 48	75 00	72 36	70 48	69 00	67 12	65 24	63 36	61 48	60 00	58 12	56 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.28	1.25	1.21	1.18	1.15	1.12	1.09	1.06	1.03	1.00	0.97	0.94	Δ_1h
Log.	0.107 21	0.096 91	0.082 79	0.071 88	0.060 70	0.049 22	0.037 43	0.025 31	0.012 84	0.00 ...	9.986 77	9.973 13	Log.
Limit	67	68	70	71	72	74	76	77	78	79	80	81	Minutes
Meridian	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	0 14	0 14	0 14	...	...	...	...	...	...	...	...	...	4
8	0 58	0 56	0 54	...	...	...	...	...	...	...	...	...	8
12	2 11	2 07	2 02	...	...	...	...	...	...	...	...	...	12
16	3 53	3 45	3 38	...	...	...	...	...	...	...	...	...	16
20	6 04	5 52	5 40	...	...	...	...	...	...	...	...	...	20
24	8 44	8 27	8 10	...	...	...	...	...	...	...	...	...	24
28	11 54	11 30	11 06	...	...	...	...	...	...	...	...	...	28
32	15 32	15 01	14 30	...	...	...	...	...	...	...	...	...	32
36	19 39	19 01	18 22	...	...	...	...	...	...	...	...	...	36
40	24 16	23 28	22 40	...	...	...	...	...	...	...	...	...	40
44	29 21	28 24	27 26	...	...	...	...	...	...	...	...	...	44
48	34 57	33 47	32 38	...	...	...	...	...	...	...	...	...	48
52	41 01	39 39	38 18	...	...	...	...	...	...	...	...	...	52
56	47 33	46 00	44 36	...	...	...	...	...	...	...	...	...	56
60	54 36	52 48	51 00	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	0.91	0.88	0.85	...	...	...	...	...	...	...	...	...	Δ_1h
Log.	9.959 04	9.944 48	9.929 42	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	82	83	84										Minutes
Meridian	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	Altitudes

Latitude 24° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	1 10	1 13	1 16	1 20	1 23	1 27	1 32	1 37	1 43	1 50	1 57	2 05	4
8	4 43	4 54	5 07	5 20	5 35	5 52	6 10	6 30	6 53	7 18	7 47	8 21	8
12	10 35	11 01	11 30	12 00	12 33	13 11	13 51	14 37	15 28	16 26	17 31	18 47	12
16	18 49	19 35	20 26	21 20	22 19	23 25	24 37	25 59	27 28	29 14	31 09	33 25	16
20	29 24	30 36	31 56	33 20	34 52	36 36	38 28	40 36	42 56	45 40	48 40	52 12	20
24	42 20	44 04	45 59	48 00	50 12	52 42	55 23	58 28	61 49	65 46	...	...	24
28	57 38	59 59	62 34	65 20	68 21	71 45	75 24	79 35	84 09	...	...	...	28
32	75 16	78 20	81 45	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.41	4.59	4.79	5.00	5.23	5.49	5.77	6.09	6.44	6.85	7.30	7.83	$\triangle_1 h$
Log.	0.644 44	0.661 81	0.680 34	0.698 97	0.718 50	0.739 57	0.761 18	0.784 62	0.808 89	0.835 69	0.863 32	0.893 76	Log.
Limit	28	27	26	25	24	23	22	21	20	19	18	17	Minutes
Meridian	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	2 15	2 27	2 40	2 57	3 18	3 45	4 21	5 11	...	...	...	...	4
8	9 01	9 46	10 41	11 49	13 13	15 01	17 24	20 46	...	...	...	...	8
12	20 16	21 59	24 03	26 36	29 44	33 48	39 10	...	...	...	...	...	12
16	36 00	39 05	42 45	...	...	...	...	...	...	...	...	...	16
20	56 16	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	8.44	9.16	10.02	11.08	12.39	14.08	16.32	19.46	...	...	...	...	$\triangle_1 h$
Log.	0.926 34	0.961 90	1.000 87	1.044 54	1.093 07	1.148 60	1.212 72	1.289 14	... ...	... ...	... ...	... ...	Log.
Limit	16	15	14	13	12	11	10	8	7	5	3	1	Minutes
Meridian	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	4 48	3 58	3 22	2 55	2 34	2 17	2 03	4
8	...	...	...	...	...	19 12	15 51	13 27	11 40	10 16	9 08	8 13	8
12	...	...	...	...	...	...	35 40	30 17	26 15	23 04	20 33	18 28	12
16	...	...	...	...	...	...	...	...	46 38	41 03	36 31	32 50	16
20	...	...	...	...	...	...	...	...	...	...	57 04	51 20	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	18.00	14.86	12.62	10.93	9.62	8.56	7.70	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	1.255 37	1.172 02	1.101 06	1.038 62	0.983 18	0.932 47	0.886 49	Log.
Limit	0	2	4	5	6	7	9	11	13	15	16	17	Minutes
Meridian	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 51	1 42	1 33	1 26	1 19	1 14	1 08	1 04	1 00	0 57	0 53	0 50	4
8	7 26	6 47	6 13	5 45	5 19	4 56	4 36	4 18	4 01	3 47	3 33	3 20	8
12	16 46	15 17	13 58	12 56	11 59	11 06	10 20	9 40	9 03	8 30	7 59	7 30	12
16	29 46	27 11	24 54	23 00	21 17	19 46	18 24	17 12	16 04	15 06	14 12	13 22	16
20	46 32	42 28	38 56	35 56	33 16	30 52	28 44	26 52	25 06	23 36	22 12	20 52	20
24	...	61 09	56 04	51 45	47 54	44 27	41 23	38 41	36 11	33 59	31 58	30 03	24
28	...	...	76 18	70 26	65 11	60 30	56 19	52 40	49 16	46 15	43 31	40 54	28
32	...	...	...	...	...	79 01	73 33	68 47	64 21	60 25	56 50	53 25	32
36	...	...	...	...	...	...	...	...	...	76 28	71 56	67 37	36
40	...	...	...	...	...	...	...	...	...	...	...	83 28	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.98	6.37	5.84	5.39	4.99	4.63	4.31	4.03	3.77	3.54	3.33	3.13	$\triangle_1 h$
Log.	0.843 86	0.804 14	0.766 41	0.731 59	0.698 10	0.665 58	0.634 48	0.605 31	0.576 34	0.549 00	0.522 44	0.495 54	Log.
Limit	19	21	23	24	25	26	27	28	29	31	32	33	Minutes
Meridian	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	Altitudes

Latitude 24° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 47	0 45	0 42	0 40	0 38	0 36	0 34	0 32	0 30	0 28	0 28	0 26	4
8	3 09	2 58	2 48	2 39	2 31	2 23	2 15	2 08	2 01	1 55	1 49	1 43	8
12	7 05	6 40	6 18	5 58	5 39	5 21	5 04	4 48	4 32	4 18	4 05	3 51	12
16	12 36	11 52	11 14	10 36	10 02	9 31	9 01	8 32	8 04	7 38	7 15	6 53	16
20	19 40	18 32	17 32	16 34	15 41	14 53	14 04	13 20	12 36	11 56	11 20	10 44	20
24	28 20	26 41	25 15	23 54	22 34	21 25	20 14	19 12	18 09	17 11	16 19	15 28	24
28	38 32	36 20	34 22	32 33	30 43	29 09	27 32	26 08	24 42	23 24	22 13	21 02	28
32	50 20	47 27	44 53	42 30	40 06	38 03	36 00	34 08	32 15	30 33	29 01	27 28	32
36	63 43	60 03	56 49	53 47	50 46	48 08	45 35	43 12	40 50	38 40	36 43	34 47	36
40	78 40	74 08	70 08	66 24	62 40	59 28	56 16	53 20	50 24	47 44	45 20	42 56	40
44	. . .	. . .	84 52	80 20	75 50	71 57	68 05	64 32	60 59	57 45	54 51	51 57	44
48	. . .	. . .	. . .	95 37	90 14	85 38	81 01	76 48	72 34	68 42	65 15	61 49	48
52	. . .	. . .	. . .	. . .	. . .	. . .	. . .	90 08	85 10	80 40	76 37	72 33	52
56	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	88 51	84 09	56
60	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.95	2.78	2.63	2.49	2.35	2.23	2.11	2.00	1.89	1.79	1.70	1.61	$\Delta_1 h$
Log.	0.469 82	0.444 04	0.419 96	0.396 20	0.371 07	0.348 30	0.324 28	0.301 03	0.276 46	0.252 85	0.230 45	0.206 83	Log.
Limit	34	35	37	39	40	41	42	43	44	45	47	49	Minutes
Meridian	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 24	0 22	0 20	0 19	0 19	0 17	0 16	0 15	0 14	0 14	0 12	4
8	1 38	1 33	1 28	1 23	1 18	1 13	1 10	1 05	1 01	0 58	0 54	0 51	8
12	3 40	3 29	3 17	3 06	2 56	2 45	2 37	2 27	2 19	2 11	2 02	1 54	12
16	6 32	6 12	5 51	5 30	5 12	4 55	4 39	4 21	4 05	3 53	3 38	3 22	16
20	10 12	9 41	9 08	8 36	8 08	7 40	7 16	6 48	6 24	6 04	5 40	5 16	20
24	14 41	13 57	13 09	12 23	11 43	11 03	10 28	9 48	9 13	8 44	8 10	7 35	24
28	20 00	18 59	17 54	16 52	15 57	15 01	14 15	13 20	12 33	11 54	11 06	10 20	28
32	26 07	24 47	23 23	22 01	20 49	19 37	18 36	17 24	16 23	15 32	14 30	13 29	32
36	33 03	31 21	29 36	27 52	26 21	24 51	23 33	22 02	20 44	19 39	18 22	17 04	36
40	40 48	38 41	36 32	34 24	32 32	30 40	29 04	27 12	25 36	24 16	22 40	21 04	40
44	49 22	46 47	44 13	41 37	39 12	37 07	35 10	32 55	30 58	29 21	27 26	25 29	44
48	58 45	55 39	52 36	49 32	46 51	44 09	41 51	39 10	36 52	34 57	32 38	30 18	48
52	68 57	65 21	61 44	58 08	54 59	51 49	49 07	45 58	43 16	41 01	38 18	35 36	52
56	79 58	75 37	71 37	67 25	63 46	60 07	56 58	53 19	50 10	47 33	44 26	41 17	56
60	91 48	87 00	82 12	77 24	73 12	69 00	65 24	61 12	57 36	54 36	51 00	47 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.53	1.45	1.37	1.29	1.22	1.15	1.09	1.02	0.96	0.91	0.85	0.79	$\Delta_1 h$
Log.	0.184 69	0.161 37	0.136 72	0.110 59	0.086 36	0.060 70	0.037 43	0.008 60	9.982 27	9.959 04	9.929 42	9.897 63	Log.
Limit	52	54	56	58	60	61	62	64	66	68	70	72	Minutes
Meridian	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 10	1 08	1 05	1 03	1 01	0 59	0 57	0 55	0 54	0 52	0 51	0 49	4
8	4 43	4 32	4 22	4 12	4 04	3 56	3 49	3 42	3 34	3 28	3 22	3 17	8
12	10 35	10 11	9 49	9 29	9 08	8 51	8 34	8 19	8 02	7 48	7 35	7 22	12
16	18 49	18 05	17 27	16 51	16 16	15 45	15 14	14 45	14 18	13 52	13 29	13 06	16
20	29 24	28 16	27 16	26 20	25 24	24 36	23 48	23 04	22 20	21 40	21 04	20 28	20
24	42 20	40 42	39 16	37 55	36 35	35 26	34 16	33 13	32 10	31 12	30 21	29 28	24
28	57 38	55 24	53 27	51 37	49 47	48 13	46 39	45 13	43 46	42 28	41 17	40 07	28
32	75 16	72 22	69 48	67 25	65 01	62 58	60 56	59 03	57 10	55 28	53 55	52 24	32
36	...	...	...	...	...	79 43	77 07	74 44	72 22	70 12	68 16	66 19	36
40	...	...	...	...	...	...	...	92 16	89 20	86 40	84 16	81 52	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.41	4.24	4.09	3.95	3.81	3.69	3.57	3.46	3.35	3.25	3.16	3.07	$\triangle_1 h$
Log.	0.644 44	0.627 37	0.611 72	0.596 60	0.580 92	0.567 03	0.552 67	0.539 08	0.525 04	0.511 88	0.499 69	0.487 14	Log.
Limit	28	29	30	31	32	32	33	33	34	35	35	36	Minutes
Meridian	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 47	0 46	0 45	0 44	0 43	0 42	0 41	0 39	0 38	0 38	0 37	0 36	4
8	3 11	3 05	3 01	2 56	2 51	2 47	2 43	2 40	2 36	2 32	2 28	2 25	8
12	7 11	6 58	6 47	6 36	6 26	6 15	6 07	5 59	5 50	5 41	5 32	5 26	12
16	12 45	12 22	12 05	11 44	11 26	11 09	10 53	10 37	10 22	10 07	9 52	9 38	16
20	19 56	19 20	18 52	18 20	17 52	17 24	17 00	16 36	16 12	15 48	15 24	15 04	20
24	28 42	27 50	27 10	26 24	25 44	25 04	24 29	23 54	23 19	22 45	22 11	21 42	24
28	39 05	37 54	36 59	35 56	35 01	34 06	33 19	32 33	31 46	30 58	30 11	29 32	28
32	51 02	49 30	48 18	46 56	45 44	44 32	43 31	42 30	41 29	40 27	39 25	38 34	32
36	64 35	62 38	61 08	59 24	57 54	56 23	55 05	53 47	52 29	51 12	49 54	48 49	36
40	79 44	77 20	75 28	73 20	71 28	69 36	68 00	66 24	64 48	63 12	61 36	60 16	40
44	...	...	...	88 44	86 29	84 13	82 17	80 20	78 24	76 39	74 32	72 55	44
48	...	...	...	...	...	...	...	95 37	93 19	91 00	88 42	86 47	48
52	...	...	...	...	...	...	...	...	...	106 48	104 06	101 51	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.99	2.90	2.83	2.75	2.68	2.61	2.55	2.49	2.43	2.37	2.31	2.26	$\triangle_1 h$
Log.	0.475 67	0.462 40	0.451 79	0.439 33	0.428 13	0.416 64	0.406 54	0.396 20	0.385 61	0.374 75	0.363 61	0.354 11	Log.
Limit	36	37	38	39	39	40	41	42	42	43	44	45	Minutes
Meridian	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	Altitudes

Latitude 24° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 35	0 34	0 33	0 32	0 31	0 31	0 30	0 30	0 28	0 27	0 27	4
8	2 22	2 17	2 14	2 12	2 09	2 05	2 02	2 00	1 57	1 55	1 52	1 50	8
12	5 18	5 09	5 02	4 57	4 49	4 43	4 37	4 31	4 23	4 18	4 12	4 06	12
16	9 26	9 11	8 58	8 47	8 35	8 21	8 11	8 01	7 49	7 38	7 28	7 18	16
20	14 44	14 20	14 00	13 44	13 24	13 04	12 48	12 32	12 12	11 56	11 40	11 24	20
24	21 13	20 39	20 10	19 47	19 18	18 49	18 26	18 03	17 34	17 11	16 48	16 25	24
28	28 53	28 05	27 26	26 55	26 16	25 37	25 06	24 34	23 55	23 24	22 52	22 21	28
32	37 43	36 41	35 50	35 09	34 18	33 27	32 46	32 05	31 14	30 33	29 52	29 11	32
36	47 44	46 27	45 22	44 30	43 25	42 20	41 28	40 37	39 32	38 40	37 48	36 56	36
40	58 56	57 20	56 00	54 56	53 36	52 16	51 12	50 08	48 48	47 44	46 40	45 36	40
44	71 18	69 23	67 46	66 28	64 51	63 14	61 57	60 40	59 03	57 45	56 28	55 10	44
48	84 52	82 33	80 38	79 06	77 11	75 16	73 44	72 11	70 16	68 42	67 10	65 38	48
52	...	...	...	...	...	...	...	84 43	82 28	80 40	78 52	77 04	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.21	2.15	2.10	2.06	2.01	1.96	1.92	1.88	1.83	1.79	1.75	1.71	$\triangle_1 h$
Log.	0.344 39	0.332 44	0.322 22	0.313 87	0.303 20	0.292 26	0.283 30	0.274 16	0.262 45	0.252 85	0.243 04	0.233 00	Log.
Limit	46	47	48	49	50	51	52	53	54	54	55	56	Minutes
Meridian	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 26	0 25	0 25	0 23	0 23	0 22	0 22	0 22	0 21	0 20	4
8	1 47	1 45	1 42	1 39	1 38	1 36	1 34	1 31	1 29	1 27	1 25	1 23	8
12	4 01	3 56	3 50	3 44	3 40	3 35	3 31	3 25	3 20	3 16	3 11	3 06	12
16	7 10	7 00	6 50	6 39	6 32	6 21	6 13	6 03	5 56	5 48	5 41	5 30	16
20	11 12	10 56	10 40	10 24	10 12	9 56	9 44	9 28	9 16	9 04	8 52	8 36	20
24	16 08	15 45	15 22	14 59	14 41	14 18	14 01	13 38	13 21	13 04	12 46	12 23	24
28	21 57	21 25	20 54	20 23	20 00	19 29	19 05	18 34	18 10	17 46	17 23	16 52	28
32	28 40	27 59	27 18	26 27	26 07	25 26	24 55	24 14	23 43	23 12	22 42	22 01	32
36	36 18	35 26	34 34	33 42	33 03	32 11	31 32	30 40	30 02	29 23	28 44	27 52	36
40	44 48	43 44	42 40	41 36	40 48	39 44	38 56	37 52	37 04	36 16	35 28	34 24	40
44	54 13	52 55	51 38	50 20	49 22	48 04	47 06	45 49	44 51	43 53	42 55	41 37	44
48	64 30	62 58	61 26	59 54	58 45	57 13	56 04	54 32	53 22	52 13	51 04	49 32	48
52	75 42	73 54	72 06	70 18	68 57	67 09	65 48	64 00	62 38	61 17	59 56	58 08	52
56	87 49	85 43	83 38	81 32	79 58	77 52	76 18	74 13	72 39	71 05	69 31	67 25	56
60	100 48	98 24	96 00	93 36	91 48	89 24	87 36	85 12	83 24	81 36	79 48	77 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.68	1.64	1.60	1.56	1.53	1.49	1.46	1.42	1.39	1.36	1.33	1.29	$\triangle_1 h$
Log.	0.225 31	0.214 84	0.204 12	0.193 12	0.184 69	0.173 19	0.164 35	0.152 29	0.143 01	0.133 54	0.123 85	0.110 59	Log.
Limit	56	57	58	59	60	61	62	63	64	65	66	67	Minutes
Meridian	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	Altitudes

Latitude 24° Declination Contrary Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 19	0 19	0 19	0 18	0 18	0 17	0 17	0 16	0 15	0 15	0 15	4
8	1 21	1 19	1 17	1 15	1 13	1 11	1 09	1 07	1 05	1 03	1 01	0 59	8
12	3 02	2 57	2 53	2 48	2 44	2 39	2 36	2 31	2 27	2 23	2 19	2 14	12
16	5 22	5 15	5 07	5 00	4 52	4 45	4 36	4 29	4 21	4 13	4 05	3 58	16
20	8 24	8 12	8 00	7 48	7 36	7 24	7 12	7 00	6 48	6 36	6 24	6 12	20
24	12 06	11 48	11 31	11 14	10 57	10 40	10 22	10 05	9 48	9 30	9 13	8 55	24
28	16 28	16 05	15 41	15 17	14 53	14 30	14 07	13 43	13 20	12 57	12 33	12 10	28
32	21 30	21 00	20 29	19 58	19 27	18 56	18 26	17 55	17 24	16 54	16 23	15 53	32
36	27 13	26 34	25 55	25 17	24 38	23 59	23 20	22 41	22 02	21 23	20 44	20 05	36
40	33 36	32 48	32 00	31 12	30 24	29 36	28 48	28 00	27 12	26 24	25 36	24 48	40
44	40 38	39 41	38 43	37 46	36 47	35 49	34 51	33 53	32 55	31 56	30 58	30 00	44
48	48 23	47 14	46 05	44 55	43 46	42 37	41 28	40 19	39 10	38 01	36 52	35 43	48
52	56 47	55 26	54 05	52 43	51 22	50 01	48 40	47 19	45 58	44 37	43 16	41 55	52
56	65 51	64 17	62 43	61 10	59 35	58 01	56 27	54 53	53 19	51 44	50 10	48 36	56
60	75 36	73 48	72 00	70 12	68 24	66 36	64 48	63 00	61 12	59 24	57 36	55 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.26	1.23	1.20	1.17	1.14	1.11	1.08	1.05	1.02	0.99	0.96	0.93	$\triangle_1$h
Log.	0.100 37	0.089 91	0.079 18	0.068 19	0.056 90	0.045 32	0.033 42	0.021 19	0.008 60	9.995 64	9.982 27	9.968 48	Log.
Limit	68	69	71	72	73	74	76	78	79	80	81	82	Minutes
Meridian	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	...	...	...	...	...	...	...	...	...	0 09	4
8	0 57	0 56	...	...	...	...	...	...	...	...	...	0 37	8
12	2 10	2 05	...	...	...	...	...	...	...	...	...	1 24	12
16	3 50	3 43	...	...	...	...	...	...	...	...	...	2 28	16
20	6 00	5 48	...	...	...	...	...	...	...	...	...	3 52	20
24	8 38	8 21	...	...	...	...	...	...	...	...	...	5 32	24
28	11 46	11 22	...	...	...	...	...	...	...	...	...	7 35	28
32	15 22	14 51	...	...	...	...	...	...	...	...	...	9 54	32
36	19 26	18 48	...	...	...	...	...	...	...	...	...	12 32	36
40	24 00	23 12	...	...	...	...	...	...	...	...	...	15 28	40
44	29 02	28 05	...	...	...	...	...	...	...	...	...	18 43	44
48	34 34	33 24	...	...	...	...	...	...	...	...	...	22 16	48
52	40 34	39 12	...	...	...	...	...	...	...	...	...	26 09	52
56	47 02	45 29	...	...	...	...	...	...	...	...	...	30 19	56
60	54 00	52 12	...	...	...	...	...	...	...	...	...	34 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.90	0.87	...	...	...	...	...	...	...	...	...	0.58	$\triangle_1$h
Log.	9.954 24	9.939 52	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.763 43	Log.
Limit	83	84										92	Minutes
Meridian	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	Altitudes

Latitude 25° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 07	1 10	1 13	1 16	1 19	1 23	1 27	1 31	1 36	1 42	1 49	1 55	4
8	4 30	4 40	4 51	5 04	5 16	5 31	5 49	6 06	6 26	6 48	7 14	7 42	8
12	10 06	10 29	10 55	11 23	11 53	12 26	13 04	13 44	14 28	15 19	16 15	17 20	12
16	17 58	18 39	19 25	20 13	21 07	22 06	23 12	24 24	25 44	27 13	28 53	30 48	16
20	28 04	29 08	30 20	31 36	33 00	34 32	36 16	38 08	40 12	42 32	45 08	48 08	20
24	40 25	41 57	43 41	45 30	47 31	49 44	52 13	54 55	57 54	61 15	64 59	69 19	24
28	55 01	57 06	59 27	61 54	64 41	67 41	71 05	74 45	78 48	83 23	...	...	28
32	71 51	74 34	77 39	80 54	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.21	4.37	4.55	4.74	4.95	5.18	5.44	5.72	6.03	6.38	6.77	7.22	$\triangle_1 h$
Log.	0.624 28	0.640 48	0.658 01	0.675 78	0.694 61	0.714 33	0.735 60	0.757 40	0.780 32	0.804 82	0.830 59	0.858 54	Log.
Limit	29	28	27	26	25	24	23	22	21	20	19	18	Minutes
Meridian	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 04	2 13	2 25	2 38	2 55	3 16	3 42	4 18	5 07	...	...	...	4
8	8 16	8 54	9 39	10 33	11 39	13 03	14 49	17 10	20 28	...	...	...	8
12	18 35	20 01	21 43	23 46	26 14	29 21	33 20	38 38	...	...	...	...	12
16	33 01	35 35	38 37	42 14	46 38	...	...	...	...	...	...	...	16
20	51 36	55 36	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	7.74	8.34	9.05	9.90	10.93	12.23	13.89	16.10	19.19	...	...	...	$\triangle_1 h$
Log.	0.888 74	0.921 17	0.956 65	0.995 64	1.038 62	1.087 43	1.142 70	1.206 83	1.283 07	... ...	... ...	... ...	Log.
Limit	18	17	16	15	14	13	12	11	10	8	6	4	Minutes
Meridian	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	Altitudes

Latitude 25° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	4 44	3 54	3 18	2 51	2 31	2 14	4
8	...	...	...	...	...	...	18 51	15 34	13 12	11 26	10 04	8 57	8
12	...	...	...	...	...	...	42 26	35 01	29 43	25 44	22 38	20 07	12
16	...	...	...	...	...	...	...	...	...	45 44	40 14	35 48	16
20	...	...	...	...	...	...	...	...	...	...	...	55 56	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	...	...	17.68	14.59	12.38	10.72	9.43	8.39	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	1.247 48	1.164 09	1.092 72	1.030 19	0.974 51	0.923 76	Log.
Limit	2	0	2	4	6	7	8	10	12	14	15	16	Minutes
Meridian	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 00	1 50	1 40	1 32	1 24	1 18	1 12	1 07	1 03	0 59	0 55	0 52	4
8	8 03	7 17	6 39	6 06	5 37	5 12	4 49	4 29	4 12	3 56	3 41	3 28	8
12	18 06	16 25	14 57	13 43	12 40	11 41	10 51	10 06	9 25	8 50	8 17	7 48	12
16	32 10	29 11	26 35	24 23	22 29	20 47	19 17	17 58	16 45	15 42	14 43	13 52	16
20	50 16	45 36	41 32	38 08	35 08	32 27	30 08	28 03	26 12	24 32	23 00	21 40	20
24	...	65 40	59 48	54 55	50 35	46 45	43 22	40 25	37 43	35 19	33 07	31 12	24
28	...	...	...	74 45	68 52	63 38	59 04	55 01	51 22	48 05	45 04	42 27	28
32	...	...	...	...	...	83 07	77 08	71 51	67 05	62 48	58 53	55 28	32
36	...	...	...	...	...	...	...	...	...	79 30	74 31	70 12	36
40	...	...	...	...	...	...	...	...	...	...	...	86 40	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	7.54	6.84	6.23	5.72	5.27	4.87	4.52	4.21	3.93	3.68	3.45	3.25	$\triangle_1$h
Log.	0.877 37	0.835 06	0.794 49	0.757 40	0.721 81	0.687 53	0.655 14	0.624 28	0.594 39	0.565 85	0.537 82	0.511 88	Log.
Limit	17	19	21	23	24	25	26	27	28	30	31	32	Minutes
Meridian	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	Altitudes

Latitude 25° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 49	0 46	0 43	0 40	0 39	0 36	0 34	0 32	0 31	0 30	0 28	0 25	4
8	3 15	3 04	2 53	2 44	2 34	2 25	2 18	2 09	2 03	1 57	1 50	1 44	8
12	7 19	6 54	6 30	6 08	5 47	5 27	5 10	4 52	4 38	4 22	4 08	3 55	12
16	13 01	12 17	11 34	10 55	10 17	9 40	9 12	8 38	8 13	7 46	7 22	6 57	16
20	20 20	19 11	18 03	17 04	16 04	15 08	14 23	13 31	12 51	12 08	11 32	10 52	20
24	29 17	27 37	26 01	24 35	23 08	21 47	20 45	19 29	18 30	17 28	16 36	15 38	24
28	39 51	37 38	35 25	33 27	31 29	29 40	28 13	26 32	25 14	23 46	22 37	21 17	28
32	52 03	49 09	46 14	43 41	41 08	38 45	36 51	34 39	32 57	31 03	29 32	27 49	32
36	65 53	62 13	58 32	55 18	52 03	49 02	46 40	43 51	41 41	39 19	37 22	35 13	36
40	81 20	76 48	72 16	68 16	64 16	60 32	57 36	54 08	51 28	48 32	46 08	43 28	40
44	...	...	87 26	82 36	77 45	73 15	69 42	65 30	62 16	58 44	55 49	52 36	44
48	...	...	...	...	92 33	87 10	82 56	77 57	74 07	69 53	66 24	62 35	48
52	...	...	...	...	...	...	...	91 29	86 59	82 01	77 58	73 27	52
56	...	...	...	...	...	...	...	...	...	...	90 25	85 12	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	3.05	2.88	2.71	2.56	2.41	2.27	2.16	2.03	1.93	1.82	1.73	1.63	△₁h
Log.	0.484 30	0.459 39	0.432 97	0.408 24	0.382 02	0.356 03	0.334 45	0.307 50	0.285 56	0.260 07	0.238 05	0.212 19	Log.
Limit	34	35	36	37	39	40	41	42	43	44	46	48	Minutes
Meridian	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 23	0 22	0 21	0 20	0 19	0 18	0 17	0 15	0 14	0 14	0 13	4
8	1 39	1 34	1 29	1 24	1 20	1 15	1 10	1 05	1 02	0 58	0 55	0 51	8
12	3 43	3 31	3 20	3 08	2 59	2 48	2 38	2 28	2 20	2 13	2 04	1 55	12
16	6 36	6 13	5 56	5 36	5 17	5 00	4 42	4 24	4 08	3 55	3 40	3 25	16
20	10 20	9 44	9 16	8 44	8 16	7 48	7 20	6 52	6 28	6 08	5 44	5 20	20
24	14 53	14 01	13 21	12 35	11 54	11 14	10 34	9 53	9 18	8 50	8 16	7 41	24
28	20 15	19 05	18 10	17 07	16 12	15 17	14 22	13 28	12 41	12 02	11 14	10 27	28
32	26 27	24 55	23 43	22 21	21 10	19 58	18 46	17 35	16 34	15 42	14 40	13 39	32
36	33 29	31 32	30 02	28 18	26 47	25 17	23 46	22 15	20 57	19 52	18 35	17 17	36
40	41 20	38 56	37 04	34 56	33 04	31 12	29 20	27 28	25 52	24 32	22 56	21 20	40
44	50 01	47 06	44 51	42 16	40 00	37 46	35 30	33 14	31 18	29 40	27 45	25 49	44
48	59 31	56 04	53 22	50 18	47 37	44 55	42 14	39 33	37 15	35 20	33 01	30 43	48
52	69 51	65 48	62 38	59 02	55 53	52 43	49 34	46 25	43 43	41 28	38 45	36 03	52
56	81 01	76 18	72 39	68 28	64 48	61 10	57 30	53 50	50 42	48 05	44 57	41 49	56
60	93 00	87 36	83 24	78 36	74 24	70 12	66 00	61 48	58 12	55 12	51 36	48 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.55	1.46	1.39	1.31	1.24	1.17	1.10	1.03	0.97	0.92	0.86	0.80	△₁h
Log.	0.190 33	0.164 35	0.143 01	0.117 27	0.093 42	0.068 19	0.041 39	0.012 84	0.986 77	0.963 79	0.934 50	0.903 09	Log.
Limit	51	53	55	57	59	60	61	63	65	67	69	71	Minutes
Meridian	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 07	1 05	1 02	1 00	0 59	0 57	0 55	0 53	0 52	0 51	0 49	0 47	4
8	4 30	4 20	4 10	4 03	3 54	3 47	3 41	3 33	3 28	3 21	3 16	3 10	8
12	10 06	9 45	9 25	9 06	8 47	8 31	8 16	7 59	7 47	7 32	7 21	7 08	12
16	17 58	17 19	16 43	16 10	15 37	15 09	14 40	14 13	13 49	13 24	13 03	12 40	16
20	28 04	27 04	26 08	25 16	24 24	23 40	22 56	22 12	21 36	20 56	20 24	19 48	20
24	40 25	38 59	37 38	36 23	35 09	34 05	33 01	31 58	31 06	30 09	29 23	28 30	24
28	55 01	53 03	51 14	49 32	47 49	46 23	44 57	43 31	42 20	41 01	39 59	38 49	28
32	71 51	69 17	66 54	64 41	62 27	60 35	58 43	56 50	55 18	53 35	52 13	50 42	32
36	...	...	...	...	79 04	76 41	74 18	71 56	69 59	67 50	66 06	64 09	36
40	...	...	...	...	...	...	91 44	88 48	86 24	83 44	81 36	79 12	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.21	4.06	3.92	3.79	3.66	3.55	3.44	3.33	3.24	3.14	3.06	2.97	$\triangle_1 h$
Log.	0.624 28	0.608 53	0.593 29	0.578 64	0.563 48	0.550 23	0.536 56	0.522 44	0.510 55	0.496 93	0.485 72	0.472 76	Log.
Limit	29	30	31	32	32	33	33	34	34	35	36	36	Minutes
Meridian	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	″	′ ″	Min.
4	0 46	0 45	0 44	0 43	0 42	0 41	0 39	0 38	0 38	0 37	0 36	0 35	4
8	3 05	3 00	2 56	2 51	2 47	2 43	2 39	2 35	2 31	2 28	2 25	2 21	8
12	6 56	6 46	6 35	6 24	6 15	6 06	5 58	5 49	5 40	5 32	5 26	5 17	12
16	12 20	12 02	11 41	11 24	11 09	10 50	10 34	10 19	10 04	9 52	9 38	9 23	16
20	19 16	18 48	18 16	17 48	17 24	16 56	16 32	16 08	15 44	15 24	15 04	14 40	20
24	27 45	27 05	26 18	25 38	25 04	24 23	23 48	23 14	22 40	22 11	21 42	21 07	24
28	37 46	36 51	35 48	34 53	34 06	33 11	32 25	31 38	30 50	30 11	29 32	28 45	28
32	49 19	48 07	46 46	45 34	44 32	43 21	42 20	41 18	40 16	39 25	38 34	37 33	32
36	62 26	60 55	59 11	57 41	56 23	54 52	53 34	52 16	50 59	49 54	48 49	47 31	36
40	77 04	75 12	73 04	71 12	69 36	67 44	66 08	64 32	62 56	61 36	60 16	58 40	40
44	...	...	88 24	86 10	84 13	81 57	80 01	78 05	76 09	74 32	72 55	70 59	44
48	...	...	...	...	...	...	95 14	92 56	90 37	88 42	86 47	84 29	48
52	...	...	...	...	...	...	...	...	106 21	104 06	101 51	99 09	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.89	2.82	2.74	2.67	2.61	2.54	2.48	2.42	2.36	2.31	2.26	2.20	$\triangle_1 h$
Log.	0.460 90	0.450 25	0.437 75	0.426 51	0.416 64	0.404 83	0.394 45	0.383 82	0.372 91	0.363 61	0.354 11	0.342 42	Log.
Limit	37	38	39	40	40	41	42	43	43	44	45	46	Minutes
Meridian	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	Altitudes

Latitude 25° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 34	0 33	0 32	0 32	0 31	0 30	0 30	0 28	0 28	0 27	0 27	4
8	2 17	2 15	2 11	2 09	2 06	2 02	2 00	1 58	1 55	1 53	1 50	1 47	8
12	5 09	5 03	4 55	4 49	4 44	4 37	4 31	4 25	4 19	4 14	4 08	4 01	12
16	9 11	9 01	8 45	8 35	8 24	8 11	8 01	7 51	7 41	7 30	7 20	7 10	16
20	14 20	14 04	13 40	13 24	13 08	12 48	12 32	12 14	12 00	11 44	11 28	11 12	20
24	20 39	20 16	19 41	19 18	18 44	18 26	18 03	17 40	17 17	16 54	16 31	16 08	24
28	28 05	27 34	26 47	26 16	25 45	25 06	24 34	24 02	23 31	23 00	22 29	21 57	28
32	36 41	36 00	34 59	34 18	33 38	32 46	32 05	31 24	30 43	30 02	29 21	28 40	32
36	46 27	45 35	44 17	43 25	42 33	41 28	40 37	39 45	38 53	38 01	37 09	36 18	36
40	57 20	56 16	54 40	53 36	52 32	51 12	50 08	49 04	48 00	46 56	45 52	44 48	40
44	69 23	68 05	66 09	64 51	63 34	61 57	60 40	59 22	58 05	56 47	55 30	54 13	44
48	82 33	81 01	78 43	77 11	75 39	73 44	72 11	70 39	69 07	67 33	66 01	64 30	48
52	96 53	95 05	92 23	90 35	88 47	86 32	84 43	82 55	81 07	79 19	77 31	75 42	52
56	...	...	...	105 03	102 57	100 21	98 15	96 10	94 05	91 59	89 54	87 49	56
60	...	...	...	...	...	...	...	110 24	108 00	105 36	103 12	100 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.15	2.11	2.05	2.01	1.97	1.92	1.88	1.84	1.80	1.76	1.72	1.68	$\Delta_1 h$
Log.	0.332 44	0.324 28	0.311 75	0.303 20	0.294 47	0.283 30	0.274 16	0.264 82	0.255 27	0.245 51	0.235 53	0.225 31	Log.
Limit	47	48	49	50	51	52	53	53	54	55	56	57	Minutes
Meridian	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 26	0 25	0 25	0 24	0 23	0 23	0 22	0 22	0 22	0 21	0 20	4
8	1 45	1 42	1 41	1 39	1 36	1 35	1 33	1 30	1 28	1 26	1 24	1 22	8
12	3 56	3 50	3 48	3 42	3 36	3 32	3 28	3 22	3 17	3 13	3 08	3 05	12
16	7 00	6 50	6 44	6 34	6 24	6 16	6 08	5 58	5 51	5 43	5 36	5 27	16
20	10 56	10 40	10 32	10 16	10 00	9 48	9 36	9 20	9 08	8 56	8 44	8 32	20
24	15 45	15 22	15 10	14 47	14 24	14 06	13 49	13 26	13 09	12 52	12 35	12 17	24
28	21 25	20 54	20 39	20 07	19 36	19 13	18 49	18 18	17 54	17 30	17 07	16 44	28
32	27 59	27 18	26 58	26 17	25 36	25 06	24 35	23 54	23 23	22 52	22 21	21 51	32
36	35 26	34 34	34 08	33 16	32 24	31 45	31 06	30 14	29 36	28 57	28 18	27 39	36
40	43 44	42 40	42 08	41 04	40 00	39 12	38 24	37 20	36 32	35 44	34 56	34 08	40
44	52 55	51 38	50 59	49 41	48 24	47 26	46 27	45 10	44 13	43 14	42 16	41 18	44
48	62 58	61 26	60 40	59 08	57 36	56 27	55 18	53 46	52 36	51 27	50 18	49 09	48
52	73 54	72 06	71 12	69 24	67 36	66 15	64 54	63 06	61 44	60 23	59 02	57 41	52
56	85 43	83 38	82 35	80 29	78 24	76 50	75 15	73 10	71 37	70 02	68 28	66 54	56
60.	98 24	96 00	94 48	92 24	90 00	88 12	86 24	84 00	82 12	80 24	78 36	76 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.64	1.60	1.58	1.54	1.50	1.47	1.44	1.40	1.37	1.34	1.31	1.28	$\Delta_1 h$
Log.	0.214 84	0.204 12	0.198 66	0.187 52	0.176 09	0.167 32	0.158 36	0.146 13	0.136 72	0.127 10	0.117 27	0.107 21	Log.
Limit	57	58	59	60	61	62	63	64	65	66	67	68	Minutes
Meridian	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 19	0 19	0 19	0 19	0 18	0 17	0 17	0 16	0 15	0 15	0 14	4
8	1 20	1 18	1 16	1 14	1 12	1 10	1 09	1 07	1 05	1 02	1 00	0 58	8
12	2 59	2 56	2 51	2 47	2 42	2 38	2 34	2 30	2 25	2 22	2 17	2 13	12
16	5 17	5 12	5 05	4 57	4 50	4 42	4 34	4 26	4 19	4 10	4 03	3 55	16
20	8 16	8 08	7 56	7 44	7 32	7 20	7 08	6 56	6 44	6 32	6 20	6 08	20
24	11 54	11 43	11 26	11 09	10 51	10 34	10 16	9 59	9 42	9 24	9 07	8 50	24
28	16 12	15 57	15 33	15 09	14 46	14 22	13 59	13 35	13 12	12 49	12 25	12 02	28
32	21 10	20 49	20 18	19 47	19 17	18 46	18 16	17 45	17 14	16 44	16 13	15 52	32
36	26 47	26 21	25 43	25 04	24 25	23 46	23 07	22 28	21 49	21 10	20 31	19 52	36
40	33 04	32 32	31 44	30 56	30 08	29 20	28 32	27 44	26 56	26 08	25 20	24 32	40
44	40 00	39 22	38 24	37 26	36 28	35 30	34 32	33 33	32 35	31 37	30 39	29 41	44
48	47 37	46 51	45 41	44 32	43 23	42 14	41 05	39 56	38 47	37 38	36 29	35 20	48
52	55 53	54 59	53 37	52 16	50 55	49 34	48 13	46 52	45 31	44 10	42 49	41 28	52
56	64 48	63 46	62 12	60 38	59 04	57 30	55 56	54 21	52 47	51 13	49 39	48 05	56
60	74 24	73 12	71 24	69 36	67 48	66 00	64 12	62 24	60 36	58 48	57 00	55 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.24	1.22	1.19	1.16	1.13	1.10	1.07	1.04	1.01	0.98	0.95	0.92	$\triangle_1 h$
Log.	0.093 42	0.086 36	0.075 55	0.064 46	0.053 08	0.041 39	0.029 38	0.017 03	0.004 32	9.991 23	9.977 72	9.963 79	Log.
Limit	69	70	72	73	74	75	76	78	79	80	81	82	Minutes
Meridian	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	...	...	...	...	...	...	...	...	...	0 10	0 09	4
8	0 57	...	...	...	...	...	...	...	...	...	0 39	0 37	8
12	2 08	...	...	...	...	...	...	...	...	...	1 27	1 24	12
16	3 48	...	...	...	...	...	...	...	...	...	2 37	2 28	16
20	5 56	...	...	...	...	...	...	...	...	...	4 04	3 52	20
24	8 33	...	...	...	...	...	...	...	...	...	5 52	5 32	24
28	11 38	...	...	...	...	...	...	...	...	...	7 58	7 35	28
32	15 11	...	...	...	...	...	...	...	...	...	10 24	9 54	32
36	19 14	...	...	...	...	...	...	...	...	...	13 11	12 32	36
40	23 44	...	...	...	...	...	...	...	...	...	16 16	15 28	40
44	28 43	...	...	...	...	...	...	...	...	...	19 41	18 43	44
48	34 10	...	...	...	...	...	...	...	...	...	23 25	22 16	48
52	40 06	...	...	...	...	...	...	...	...	...	27 29	26 09	52
56	46 31	...	...	...	...	...	...	...	...	...	31 53	30 19	56
60	53 24	...	...	...	...	...	...	...	...	...	36 36	34 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.89	...	...	...	...	...	...	...	...	...	0.61	0.58	$\triangle_1 h$
Log.	9.949 39	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.785 33	9.763 43	Log.
Limit	83										92	92	Minutes
Meridian	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	Altitudes

Latitude 26° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 04	1 07	1 10	1 12	1 15	1 18	1 22	1 26	1 31	1 35	1 41	1 47	4
8	4 18	4 27	4 38	4 49	5 01	5 14	5 28	5 44	6 02	6 21	6 44	7 08	8
12	9 40	10 02	10 25	10 49	11 17	11 47	12 18	12 55	13 35	14 19	15 08	16 03	12
16	17 12	17 50	18 31	19 15	20 03	20 57	21 54	22 57	24 09	25 25	26 56	28 33	16
20	26 52	27 52	28 56	30 04	31 20	32 44	34 12	35 52	37 44	39 44	42 04	44 36	20
24	38 41	40 08	41 40	43 18	45 07	47 08	49 15	51 39	54 21	57 13	60 35	64 14	24
28	52 40	54 37	56 42	58 56	61 25	64 10	67 02	70 18	73 57	77 53	82 27	...	28
32	68 47	71 20	74 04	76 58	80 13	...	...	...	...	...	...	...	32
36	87 03	90 18	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.03	4.18	4.34	4.51	4.70	4.91	5.13	5.38	5.66	5.96	6.31	6.69	$\triangle_1 h$
Log.	0.605 31	0.621 18	0.637 49	0.654 18	0.672 10	0.691 08	0.710 12	0.730 78	0.752 82	0.775 25	0.800 03	0.825 43	Log.
Limit	30	29	28	27	26	25	24	23	22	21	21	20	Minutes
Meridian	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 55	2 03	2 12	2 22	2 36	2 52	3 13	3 39	4 14	5 02	...	...	4
8	7 37	8 09	8 48	9 31	10 26	11 31	12 52	14 36	16 56	20 09	...	...	8
12	17 08	18 20	19 47	21 26	23 27	25 54	28 57	32 51	38 05	...	...	...	12
16	30 28	32 36	35 09	38 06	41 41	46 02	...	...	...	...	...	...	16
20	47 36	50 56	54 56	...	...	...	...	...	...	...	...	...	20
24	68 33	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	7.14	7.64	8.24	8.93	9.77	10.79	12.06	13.69	15.87	18.90	...	...	$\triangle_1 h$
Log.	0.853 70	0.883 09	0.915 93	0.950 85	0.989 89	1.033 02	1.081 35	1.136 40	1.200 58	1.276 46	... ...	... ...	Log.
Limit	19	18	17	16	15	14	13	12	11	10	8	6	Minutes
Meridian	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	Altitudes

Latitude 26° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	4 38	3 49	3 15	2 48	2 28	4
8	...	...	...	...	...	...	...	18 31	15 16	12 57	11 13	9 51	8
12	...	...	...	...	...	...	...	41 40	34 22	29 08	25 13	22 10	12
16	...	...	...	...	...	...	...	...	...	...	44 51	39 24	16
20	...	...	...	...	...	...	...	...	...	...	...	61 36	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	17.36	14.32	12.14	10.51	9.24	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.239 55	1.155 94	1.084 22	1.021 60	0.965 67	Log.
Limit	4	2	0	2	4	6	7	8	10	12	13	15	Minutes
Meridian	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 11	1 58	1 47	1 38	1 29	1 23	1 16	1 10	1 06	1 01	0 57	0 54	4
8	8 46	7 53	7 08	6 30	5 58	5 29	5 05	4 42	4 23	4 05	3 49	3 35	8
12	19 44	17 44	16 03	14 38	13 25	12 21	11 26	10 35	9 51	9 11	8 36	8 04	12
16	35 04	31 32	28 33	26 02	23 51	21 59	20 18	18 49	17 33	16 21	15 16	14 20	16
20	54 48	49 16	44 36	40 40	37 16	34 20	31 44	29 24	27 24	25 32	23 52	22 24	20
24	...	...	64 14	58 34	53 40	49 27	45 42	42 20	39 28	36 46	34 22	32 16	24
28	...	...	...	...	73 01	67 17	62 10	57 38	53 42	50 03	46 47	43 54	28
32	...	...	...	...	...	...	...	75 16	70 08	65 22	61 06	57 20	32
36	...	...	...	...	...	...	...	...	...	...	77 20	72 35	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	8.22	7.39	6.69	6.10	5.59	5.15	4.76	4.41	4.11	3.83	3.58	3.36	$\triangle_1 h$
Log.	0.914 87	0.868 64	0.825 43	0.785 33	0.747 41	0.711 81	0.677 61	0.644 44	0.613 84	0.583 20	0.553 88	0.526 34	Log.
Limit	16	18	20	22	23	24	25	26	27	29	30	31	Minutes
Meridian	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	Altitudes

Latitude 26° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 50	0 47	0 44	0 42	0 40	0 38	0 35	0 33	0 31	0 30	0 28	0 27	4
8	3 21	3 10	2 59	2 48	2 39	2 30	2 22	2 14	2 05	2 00	1 53	1 47	8
12	7 33	7 08	6 42	6 18	5 58	5 37	5 18	5 01	4 44	4 29	4 14	4 00	12
16	13 27	12 40	11 54	11 14	10 34	10 00	9 26	8 55	8 24	8 00	7 30	7 08	16
20	21 00	19 48	18 36	17 32	16 32	15 36	14 44	13 56	13 08	12 28	11 44	11 08	20
24	30 15	28 30	26 47	25 15	23 48	22 28	21 13	20 04	18 44	17 57	16 54	16 02	24
28	41 09	38 49	36 28	34 22	32 25	30 34	28 53	27 19	25 48	24 26	22 59	21 49	28
32	53 45	50 42	47 37	44 53	42 20	39 56	37 43	35 40	33 38	31 55	30 02	28 30	32
36	68 03	64 09	60 16	56 49	53 34	50 33	47 44	45 09	42 33	40 24	38 01	36 05	36
40	84 00	79 12	74 24	70 08	66 08	62 24	58 56	55 44	52 32	49 52	46 56	44 32	40
44	...	...	...	84 52	80 01	75 30	71 18	67 26	63 34	60 21	56 47	53 54	44
48	...	...	...	...	...	89 51	84 52	80 15	75 39	71 48	67 33	64 07	48
52	...	...	...	...	...	...	...	...	88 47	84 16	79 19	75 15	52
56	...	...	...	...	...	...	...	...	...	...	91 59	87 18	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.15	2.97	2.79	2.63	2.48	2.34	2.21	2.09	1.97	1.87	1.76	1.67	$\triangle_1 h$
Log.	0.498 31	0.472 76	0.445 60	0.419 96	0.394 45	0.369 22	0.344 39	0.320 15	0.294 47	0.271 84	0.245 51	0.222 72	Log.
Limit	33	34	35	36	38	39	40	42	43	44	46	48	Minutes
Meridian	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 23	0 22	0 21	0 20	0 19	0 18	0 17	0 15	0 15	0 14	0 13	4
8	1 41	1 36	1 30	1 25	1 21	1 16	1 11	1 07	1 02	0 59	0 55	0 51	8
12	3 48	3 35	3 23	3 11	3 02	2 51	2 41	2 31	2 22	2 14	2 05	1 56	12
16	6 44	6 21	6 01	5 41	5 22	5 05	4 47	4 29	4 10	3 58	3 43	3 28	16
20	10 32	9 56	9 24	8 52	8 24	7 56	7 28	7 00	6 32	6 12	5 48	5 24	20
24	15 10	14 18	13 32	12 46	12 06	11 26	10 46	10 05	9 24	8 55	8 21	7 47	24
28	20 39	19 29	18 26	17 23	16 28	15 33	14 38	13 43	12 49	12 10	11 22	10 35	28
32	26 58	25 26	24 04	22 42	21 30	20 18	19 06	17 55	16 44	15 53	14 51	13 49	32
36	34 08	32 11	30 27	28 44	27 13	25 43	24 12	22 41	21 10	20 05	18 48	17 30	36
40	42 08	39 44	37 36	35 28	33 36	31 44	29 52	28 00	26 08	24 48	23 12	21 36	40
44	50 59	48 04	45 29	42 55	40 39	38 24	36 09	33 53	31 37	30 00	28 05	26 08	44
48	60 40	57 13	54 09	51 04	48 23	45 41	43 00	40 19	37 38	35 43	33 24	31 06	48
52	71 12	67 09	63 33	59 56	56 47	53 37	50 28	47 19	44 10	41 55	39 12	36 30	52
56	82 35	77 52	73 41	69 31	65 51	62 12	58 33	54 53	51 13	48 36	45 29	42 20	56
60	94 48	89 24	84 36	79 48	75 36	71 24	67 12	63 00	58 48	55 48	52 12	48 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.58	1.49	1.41	1.33	1.26	1.19	1.12	1.05	0.98	0.93	0.87	0.81	$\triangle_1 h$
Log.	0.198 66	0.173 19	0.149 22	0.123 85	0.100 37	0.075 55	0.049 22	0.021 19	9.991 23	9.968 48	9.939 52	9.908 49	Log.
Limit	50	52	54	56	58	59	60	62	64	66	68	70	Minutes
Meridian	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 04	1 02	1 00	0 59	0 56	0 54	0 53	0 51	0 50	0 49	0 47	0 46	4
8	4 18	4 09	4 01	3 53	3 45	3 39	3 32	3 26	3 20	3 15	3 09	3 04	8
12	9 40	9 20	9 02	8 44	8 27	8 11	7 56	7 44	7 30	7 18	7 07	6 55	12
16	17 12	16 36	16 02	15 32	15 01	14 33	14 08	13 44	13 22	12 58	12 37	12 17	16
20	26 52	25 56	25 04	24 16	23 28	22 44	22 04	21 28	20 52	20 16	19 44	19 12	20
24	38 41	37 21	36 06	34 57	33 48	32 44	31 47	30 55	30 03	29 11	28 25	27 39	24
28	52 40	50 50	49 08	47 33	46 00	44 34	43 15	42 05	40 54	39 43	38 41	37 38	28
32	68 47	66 23	64 10	62 07	60 04	58 12	56 29	54 57	53 25	51 53	50 31	49 09	32
36	...	...	...	78 38	76 02	73 39	71 30	69 33	67 37	65 40	63 56	62 13	36
40	...	...	...	...	...	90 56	88 16	85 52	83 28	81 04	78 56	76 48	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	4.03	3.89	3.76	3.64	3.52	3.41	3.31	3.22	3.13	3.04	2.96	2.88	$\Delta_1 h$
Log.	0.605 31	0.589 95	0.575 19	0.561 10	0.546 54	0.532 75	0.519 83	0.507 86	0.495 54	0.482 87	0.471 29	0.459 39	Log.
Limit	30	31	32	33	34	34	35	35	36	36	37	37	Minutes
Meridian	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 45	0 43	0 43	0 42	0 41	0 39	0 38	0 38	0 37	0 36	0 35	0 35	4
8	2 59	2 55	2 50	2 46	2 43	2 39	2 35	2 31	2 28	2 24	2 21	2 17	8
12	6 43	6 33	6 23	6 14	6 06	5 56	5 49	5 40	5 32	5 24	5 17	5 09	12
16	11 57	11 39	11 21	11 06	10 50	10 32	10 19	10 04	9 52	9 36	9 23	9 11	16
20	18 40	18 12	17 44	17 20	16 56	16 28	16 08	15 44	15 24	15 00	14 40	14 20	20
24	26 53	26 12	25 33	24 58	24 23	23 42	23 14	22 40	22 11	21 36	21 07	20 39	24
28	36 35	35 41	34 45	33 58	33 11	32 17	31 38	30 50	30 11	29 24	28 45	28 05	28
32	47 47	46 36	45 23	44 22	43 21	42 10	41 18	40 16	39 25	38 24	37 33	36 41	32
36	60 29	58 58	57 28	56 10	54 52	53 21	52 16	50 59	49 54	48 36	47 31	46 27	36
40	74 40	72 48	70 56	69 20	67 44	65 52	64 32	62 56	61 36	60 00	58 40	57 20	40
44	...	88 05	85 50	83 54	81 57	79 42	78 05	76 09	74 32	72 36	70 59	69 23	44
48	...	...	...	99 50	97 32	94 51	92 56	90 37	88 42	86 24	84 29	82 33	48
52	...	...	...	...	...	...	...	106 21	104 06	101 24	99 09	96 53	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.80	2.73	2.66	2.60	2.54	2.47	2.42	2.36	2.31	2.25	2.20	2.15	$\Delta_1 h$
Log.	0.447 16	0.436 16	0.424 88	0.414 97	0.404 83	0.392 70	0.383 82	0.372 91	0.363 61	0.352 18	0.342 42	0.332 44	Log.
Limit	38	39	40	41	41	42	43	43	44	45	46	47	Minutes
Meridian	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 34	0 33	0 32	0 31	0 30	0 30	0 30	0 29	0 28	0 27	0 27	0 27	4
8	2 14	2 12	2 09	2 05	2 03	2 00	1 58	1 56	1 53	1 50	1 48	1 45	8
12	5 02	4 57	4 49	4 44	4 38	4 31	4 26	4 20	4 14	4 08	4 03	3 57	12
16	8 58	8 47	8 35	8 24	8 14	8 01	7 54	7 44	7 30	7 20	7 13	7 03	16
20	14 00	13 44	13 24	13 08	12 52	12 32	12 20	12 04	11 44	11 28	11 16	11 00	20
24	20 10	19 47	19 18	18 44	18 31	18 03	17 46	17 23	16 54	16 31	16 14	15 51	24
28	27 26	26 55	26 16	25 45	25 14	24 34	24 10	23 39	23 00	22 29	22 05	21 33	28
32	35 50	35 09	34 18	33 38	32 57	32 05	31 34	30 53	30 02	29 21	28 50	28 09	32
36	45 22	44 30	43 25	42 33	41 41	40 37	39 58	39 06	38 01	37 09	36 31	35 39	36
40	56 00	54 56	53 36	52 32	51 28	50 08	49 20	48 16	46 56	45 52	45 04	44 00	40
44	67 46	66 28	64 51	63 34	62 16	60 40	59 42	58 24	56 47	55 30	54 32	53 15	44
48	80 38	79 06	77 11	75 39	74 07	72 11	71 02	69 30	67 33	66 01	64 53	63 21	48
52	94 38	92 50	90 35	88 47	86 59	84 43	83 22	81 34	79 19	77 31	76 09	74 21	52
56	109 46	107 40	105 03	102 58	100 52	98 15	96 42	94 36	91 59	89 54	88 20	86 15	56
60	. . .	. . .	. . .	118 12	115 48	112 48	111 00	108 36	105 36	103 12	101 24	99 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.10	2.06	2.01	1.97	1.93	1.88	1.85	1.81	1.76	1.72	1.69	1.65	$\triangle_1 h$
Log.	0.322 22	0.313 87	0.303 20	0.294 47	0.285 56	0.274 16	0.267 17	0.257 68	0.245 51	0.235 53	0.227 89	0.217 48	Log.
Limit	48	49	50	51	51	52	53	53	54	55	56	57	Minutes
Meridian	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 26	0 25	0 25	0 24	0 23	0 23	0 22	0 22	0 22	0 21	0 20	0 20	4
8	1 42	1 41	1 39	1 36	1 35	1 33	1 30	1 28	1 26	1 24	1 23	1 21	8
12	3 51	3 48	3 43	3 37	3 34	3 29	3 23	3 19	3 14	3 10	3 06	3 02	12
16	6 53	6 44	6 37	6 27	6 18	6 11	6 01	5 53	5 46	5 38	5 30	5 22	16
20	10 44	10 32	10 20	10 04	9 52	9 40	9 24	9 12	9 00	8 48	8 36	8 24	20
24	15 28	15 10	14 53	14 30	14 12	13 55	13 32	13 15	12 58	12 41	12 23	12 06	24
28	21 02	20 39	20 15	19 44	19 21	18 57	18 26	18 02	17 38	17 15	16 52	16 28	28
32	27 28	26 58	26 27	25 46	25 16	24 45	24 04	23 33	23 02	22 31	22 01	21 30	32
36	34 47	34 08	33 29	32 37	31 58	31 19	30 27	29 49	29 10	28 31	27 52	27 13	36
40	42 56	42 08	41 20	40 16	39 28	38 40	37 36	36 48	36 00	35 12	34 24	33 36	40
44	51 57	50 59	50 01	48 43	47 45	46 47	45 29	44 32	43 34	42 36	41 37	40 39	44
48	61 49	60 40	59 31	57 59	56 50	55 41	54 09	52 59	51 50	50 41	49 32	48 23	48
52	72 33	71 12	69 51	68 03	66 42	65 21	63 33	62 11	60 50	59 29	58 08	56 47	52
56	84 09	82 35	81 01	78 55	77 21	75 47	73 41	72 08	70 34	69 00	67 25	65 51	56
60	96 36	94 48	93 00	90 36	88 48	87 00	84 36	82 48	81 00	79 12	77 24	75 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.61	1.58	1.55	1.51	1.48	1.45	1.41	1.38	1.35	1.32	1.29	1.26	$\triangle_1 h$
Log.	0.206 83	0.198 66	0.190 33	0.178 98	0.170 26	0.161 37	0.149 22	0.139 88	0.130 33	0.120 57	0.110 59	0.100 37	Log.
Limit	58	59	60	61	62	63	64	65	66	66	67	68	Minutes
Meridian	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 19	0 19	0 19	0 18	0 17	0 17	0 16	0 16	0 15	0 15	0 14	4
8	1 19	1 17	1 15	1 13	1 11	1 09	1 07	1 05	1 04	1 02	1 00	0 58	8
12	2 57	2 53	2 48	2 44	2 39	2 36	2 31	2 27	2 24	2 20	2 16	2 11	12
16	5 15	5 07	5 00	4 52	4 45	4 36	4 29	4 21	4 16	4 08	4 00	3 53	16
20	8 12	8 00	7 48	7 36	7 24	7 12	7 00	6 48	6 40	6 28	6 16	6 04	20
24	11 48	11 31	11 14	10 57	10 40	10 22	10 05	9 48	9 36	9 18	9 01	8 44	24
28	16 05	15 41	15 17	14 53	14 30	14 07	13 43	13 20	13 04	12 41	12 17	11 54	28
32	21 00	20 29	19 58	19 27	18 56	18 26	17 55	17 24	17 04	16 34	16 03	15 32	32
36	26 34	25 55	25 17	24 38	23 59	23 20	22 41	22 02	21 36	20 57	20 18	19 39	36
40	32 48	32 00	31 12	30 24	29 36	28 48	28 00	27 12	26 40	25 52	25 04	24 16	40
44	39 41	38 43	37 46	36 47	35 49	34 51	33 53	32 55	32 16	31 18	30 19	29 21	44
48	47 14	46 05	44 55	43 46	42 37	41 28	40 19	39 10	38 24	37 15	36 06	34 57	48
52	55 26	54 05	52 43	51 22	50 01	48 40	47 19	45 58	45 04	43 43	42 22	41 01	52
56	64 17	62 43	61 10	59 35	58 01	56 27	54 53	53 19	52 16	50 42	49 07	47 33	56
60	73 48	72 00	70 12	68 24	66 36	64 48	63 00	61 12	60 00	58 12	56 24	54 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.23	1.20	1.17	1.14	1.11	1.08	1.05	1.02	1.00	0.97	0.94	0.91	$\triangle_1 h$
Log.	0.089 91	0.079 18	0.068 19	0.056 90	0.045 32	0.033 42	0.021 19	0.008 60	0.00 ...	9.986 77	9:973 13	9.959 04	Log.
Limit	69	70	72	73	74	75	76	78	79	80	81	82	Minutes
Meridian	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Augles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	...	0 10	0 10	0 09	4
8	...	...	...	...	...	...	...	...	...	0 40	0 39	0 38	8
12	...	...	...	...	...	...	...	...	...	1 30	1 27	1 25	12
16	...	...	...	...	...	...	...	...	...	2 42	2 37	2 31	16
20	...	...	...	...	...	...	...	...	...	4 12	4 04	3 56	20
24	...	...	...	...	...	...	...	...	...	6 03	5 52	5 40	24
28	...	...	...	...	...	...	...	...	...	8 14	7 58	7 43	28
32	...	...	...	...	...	...	...	...	...	10 45	10 24	10 04	32
36	...	...	...	...	...	...	...	...	...	13 37	13 11	12 45	36
40	...	...	...	...	...	...	...	...	...	16 48	16 16	15 44	40
44	...	...	...	...	...	...	...	...	...	20 20	19 41	19 02	44
48	...	...	...	...	...	...	...	...	...	24 11	23 25	22 39	48
52	...	...	...	...	...	...	...	...	...	28 23	27 29	26 35	52
56	...	...	...	...	...	...	...	...	...	32 56	31 53	30 50	56
60	...	...	...	...	...	...	...	...	...	37 48	36 36	35 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	...	...	0.63	0.61	0.59	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.799 34	9.785 33	9.770 85	Log.
Limit										91	92	93	Minutes
Meridian	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 02	1 03	1 07	1 09	1 11	1 15	1 18	1 21	1 25	1 29	1 34	1 39	4
8	4 06	4 15	4 25	4 35	4 47	4 57	5 11	5 25	5 40	5 58	6 17	6 39	8
12	9 14	9 35	9 56	10 19	10 44	11 09	11 40	12 12	12 46	13 25	14 08	14 57	12
16	16 26	17 01	17 40	18 21	19 04	19 51	20 44	21 40	22 42	23 51	25 08	26 35	16
20	25 40	26 36	27 36	28 40	29 48	31 00	32 24	33 52	35 28	37 16	39 16	41 32	20
24	36 58	38 18	39 45	41 17	42 53	44 39	46 40	48 46	51 05	53 40	56 33	59 48	24
28	50 18	52 09	54 05	56 11	58 25	60 45	63 30	66 23	69 31	73 01	76 58	81 25	28
32	65 42	68 06	70 39	73 23	76 18	79 21	82 56	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.85	3.99	4.14	4.30	4.47	4.65	4.86	5.08	5.32	5.59	5.89	6.23	$\triangle_1 h$
Log.	0.585 46	0.600 97	0.617 00	0.633 47	0.650 31	0.667 45	0.686 64	0.705 86	0.725 91	0.747 41	0.770 12	0.794 49	Log.
Limit	31	30	29	28	27	26	25	24	23	22	22	21	Minutes
Meridian	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 46	1 53	2 01	2 10	2 21	2 34	2 51	3 10	3 35	4 11	4 58	...	4
8	7 03	7 31	8 03	8 40	9 24	10 16	11 21	12 41	14 24	16 40	19 51	...	8
12	15 51	16 55	18 07	19 30	21 08	23 06	25 32	28 32	32 23	37 30	...	...	12
16	28 13	30 05	32 13	34 42	37 36	41 06	45 24	...	...	...	...	...	16
20	44 04	47 00	50 20	54 12	...	...	...	...	...	...	...	...	20
24	63 28	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.61	7.05	7.55	8.13	8.81	9.63	10.64	11.89	13.49	15.63	18.61	...	$\triangle_1 h$
Log.	0.820 20	0.848 19	0.877 95	0.910 09	0.944 98	0.983 63	1.026 94	1.075 18	1.130 01	1.193 96	1.269 75	... ...	Log.
Limit	20	19	18	17	16	15	14	13	11	10	9	8	Minutes
Meridian	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	Altitudes

Latitude 27° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	4 32	3 44	3 10	2 45	4
8	...	...	...	...	...	...	...	...	18 09	14 59	12 41	10 59	8
12	...	...	...	...	...	...	...	...	40 51	33 42	28 34	24 43	12
16	...	...	...	...	...	...	...	...	...	...	...	43 57	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	...	...	...	...	17.02	14.04	11.90	10.30	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.230 96	1.147 37	1.075 55	1.012 84	Log.
Limit	6	4	2	0	2	4	5	7	9	11	12	13	Minutes
Meridian	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 25	2 09	1 55	1 45	1 35	1 27	1 20	1 15	1 09	1 04	1 00	0 55	4
8	9 39	8 35	7 43	6 59	6 21	5 50	5 21	4 57	4 35	6 16	4 00	3 44	8
12	21 43	19 19	17 21	15 42	14 19	13 07	12 03	11 08	10 19	9 36	8 57	8 23	12
16	38 37	34 21	30 51	27 54	25 25	23 17	21 25	19 48	18 21	17 04	15 55	14 53	16
20	...	...	48 12	43 36	39 44	36 24	33 28	30 56	28 40	26 40	24 52	23 16	20
24	...	...	...	62 47	57 13	52 25	48 12	44 33	41 17	38 24	35 48	33 30	24
28	...	...	...	...	...	71 21	65 36	60 37	56 11	52 16	48 45	45 37	28
32	...	...	...	...	...	...	...	...	73 23	68 16	63 40	59 34	32
36	...	...	...	...	...	...	...	...	...	...	...	75 23	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	9.05	8.05	7.23	6.54	5.96	5.46	5.02	4.64	4.30	4.00	3.73	3.49	$\triangle_1$h
Log.	0.956 65	0.905 80	0.859 14	0.815 58	0.775 25	0.737 19	0.700 70	0.666 52	0.633 47	0.602 06	0.571 71	0.542 83	Log.
Limit	14	15	17	19	21	23	24	25	26	28	29	30	Minutes
Meridian	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	Altitudes

Latitude 27° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 52	0 49	0 46	0 43	0 41	0 38	0 36	0 35	0 32	0 30	0 29	0 27	4
8	3 30	3 16	3 04	2 54	2 43	2 34	2 26	2 17	2 09	2 02	1 55	1 49	8
12	7 51	7 21	6 55	6 30	6 07	5 46	5 27	5 08	4 51	4 35	4 19	4 05	12
16	13 57	13 03	12 17	11 34	10 53	10 14	9 41	9 08	8 37	8 09	7 41	7 15	16
20	21 48	20 24	19 12	18 04	17 00	16 00	15 08	14 16	13 28	12 44	12 00	11 20	20
24	31 23	29 23	27 39	26 01	24 29	23 02	21 47	20 33	19 24	18 20	17 17	16 19	24
28	42 44	39 59	37 38	35 25	33 19	31 22	29 40	27 57	26 24	24 58	23 31	22 13	28
32	55 49	52 13	49 09	46 15	43 31	40 58	38 45	36 31	34 28	32 36	30 43	29 01	32
36	70 38	66 06	62 13	58 32	55 05	51 50	49 02	46 14	43 38	41 15	38 53	36 43	36
40	...	81 36	76 48	72 16	68 00	64 00	60 32	57 04	53 52	50 56	48 00	45 20	40
44	...	...	...	...	82 17	77 26	73 15	69 03	65 11	61 37	58 05	54 51	44
48	...	...	...	...	...	...	87 10	82 10	77 34	73 21	69 07	65 15	48
52	...	...	...	...	...	...	...	...	...	86 05	81 07	76 37	52
56	...	...	...	...	...	...	...	...	...	...	...	88 51	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.27	3.06	2.88	2.71	2.55	2.40	2.27	2.14	2.02	1.91	1.80	1.70	$\triangle_1 h$
Log.	0.514 55	0.485 72	0.459 39	0.432 97	0.406 54	0.380 21	0.356 03	0.330 41	0.305 35	0.281 03	0.255 27	0.230 45	Log.
Limit	32	33	34	35	37	38	39	41	42	43	45	47	Minutes
Meridian	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 26	0 24	0 22	0 22	0 20	0 19	0 18	0 17	0 16	0 15	0 14	0 13	4
8	1 42	1 38	1 32	1 26	1 21	1 17	1 12	1 08	1 04	1 00	0 56	0 52	8
12	3 51	3 39	3 24	3 14	3 03	2 53	2 42	2 33	2 24	2 16	2 07	1 58	12
16	6 53	6 29	6 11	5 46	5 25	5 07	4 50	4 31	4 16	4 00	3 45	3 30	16
20	10 44	10 08	9 32	9 00	8 28	8 00	7 32	7 04	6 40	6 16	5 52	5 28	20
24	15 28	14 36	13 43	12 58	12 11	11 31	10 51	10 11	9 36	9 01	8 27	7 53	24
28	21 02	19 52	18 42	17 38	16 36	15 41	14 46	13 51	13 04	12 17	11 30	10 43	28
32	27 28	25 56	24 25	23 02	21 41	20 29	19 17	18 05	17 04	16 03	15 01	13 59	32
36	34 47	32 50	30 53	29 10	27 26	25 55	24 25	22 54	21 36	20 18	19 01	17 43	36
40	42 56	40 32	38 08	36 00	33 52	32 00	30 08	28 16	26 40	25 04	23 28	21 52	40
44	51 57	49 03	46 08	43 34	40 59	38 43	36 28	34 12	32 16	30 19	28 24	26 28	44
48	61 49	58 22	54 55	51 50	48 46	46 05	43 23	40 42	38 24	36 06	33 47	31 29	48
52	72 33	68 30	64 27	60 50	57 14	54 05	50 55	47 46	45 04	42 22	39 39	36 57	52
56	84 09	79 27	74 44	70 34	66 23	62 43	59 04	55 24	52 16	49 07	46 00	42 52	56
60	96 36	91 12	85 48	81 00	76 12	72 00	67 48	63 36	60 00	56 24	52 48	49 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.61	1.52	1.43	1.35	1.27	1.20	1.13	1.06	1.00	0.94	0.88	0.82	$\triangle_1 h$
Log.	0.206 83	0.181 84	0.155 34	0.130 33	0.103 80	0.079 18	0.053 08	0.025 31	0.00 ...	9.973 13	9.944 48	9.913 81	Log.
Limit	49	51	53	55	57	58	59	61	63	65	67	69	Minutes
Meridian	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	Altitudes

Latitude 27° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 02	0 59	0 58	0 55	0 54	0 52	0 51	0 50	0 48	0 47	0 46	0 44	4
8	4 06	4 00	3 51	3 44	3 37	3 31	3 24	3 19	3 13	3 08	3 03	2 59	8
12	9 14	8 57	8 39	8 23	8 08	7 54	7 39	7 27	7 15	7 04	6 52	6 42	12
16	16 26	15 55	15 25	14 53	14 28	14 02	13 37	13 17	12 53	12 32	12 12	11 54	16
20	25 40	24 52	24 04	23 16	22 36	21 56	21 16	20 44	20 08	19 36	19 04	18 36	20
24	36 58	35 48	34 40	33 30	32 33	31 35	30 38	29 52	29 00	28 13	27 28	26 47	24
28	50 18	48 45	47 10	45 37	44 18	43 00	41 41	40 38	39 28	38 25	37 22	36 28	28
32	65 42	63 40	61 36	59 34	57 51	56 09	54 26	53 04	51 32	50 11	48 48	47 37	32
36	...	...	77 59	75 23	73 14	71 04	68 55	67 11	65 14	63 30	61 47	60 16	36
40	...	...	...	...	90 24	87 44	85 04	82 56	80 32	78 24	76 16	74 24	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.85	3.73	3.61	3.49	3.39	3.29	3.19	3.11	3.02	2.94	2.86	2.79	$\triangle_1 h$
Log.	0.585 46	0.571 71	0.557 51	0.542 83	0.530 20	0.517 20	0.503 79	0.492 76	0.480 01	0.468 35	0.456 37	0.445 60	Log.
Limit	30	31	32	33	34	35	35	36	37	38	38	39	Minutes
Meridian	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 43	0 41	0 40	0 39	0 38	0 38	0 37	0 36	0 35	0 35	0 34	4
8	2 54	2 49	2 46	2 42	2 39	2 35	2 30	2 27	2 24	2 21	2 17	2 14	8
12	6 32	6 21	6 13	6 04	5 56	5 47	5 38	5 31	5 24	5 17	5 09	5 02	12
16	11 36	11 19	11 03	10 48	10 32	10 17	10 02	9 49	9 36	9 23	9 11	8 58	16
20	18 08	17 40	17 16	16 52	16 28	16 04	15 40	15 20	15 00	14 40	14 20	14 00	20
24	26 07	25 27	24 52	24 17	23 42	23 08	22 34	22 05	21 36	21 07	20 39	20 10	24
28	35 33	34 37	33 51	33 04	32 17	31 30	30 42	30 03	29 24	28 45	28 05	27 26	28
32	46 25	45 13	44 12	43 11	42 10	41 08	40 06	39 15	38 24	37 33	36 41	35 50	32
36	58 45	57 15	55 57	54 39	53 21	52 03	50 46	49 41	48 36	47 31	46 27	45 22	36
40	72 32	70 40	69 04	67 28	65 52	64 16	62 40	61 20	60 00	58 40	57 20	56 00	40
44	87 46	85 31	83 34	81 38	79 42	77 45	75 50	74 13	72 36	70 59	69 23	67 46	44
48	...	...	...	...	94 51	92 33	90 14	88 19	86 24	84 29	82 33	80 38	48
52	...	...	...	...	...	...	105 54	103 39	101 24	99 09	96 53	94 38	52
56	...	...	...	...	...	...	...	...	...	...	...	...	
60	...	...	...	...	...	...	...	...	...	...	...	...	
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.72	2.65	2.59	2.53	2.47	2.41	2.35	2.30	2.25	2.20	2.15	2.10	$\triangle$
Log.	0.434 57	0.423 25	0.413 30	0.403 12	0.392 70	0.382 02	0.371 07	0.361 73	0.352 18	0.342 42	0.332 44	0.322 22	Log.
Limit	39	40	41	42	42	43	44	45	45	46	47	48	Minutes
Meridian	51•	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	Altitudes

Latitude 27° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 33	0 32	0 31	0 30	0 30	0 30	0 29	0 28	0 27	0 27	0 27	0 26	4
8	2 12	2 09	2 05	2 03	2 01	1 58	1 56	1 54	1 51	1 48	1 46	1 43	8
12	4 57	4 49	4 44	4 38	4 32	4 26	4 20	4 16	4 09	4 03	3 59	3 53	12
16	8 47	8 35	8 24	8 14	8 04	7 54	7 44	7 33	7 23	7 13	7 05	6 55	16
20	13 44	13 24	13 08	12 52	12 36	12 20	12 04	11 48	11 32	11 16	11 04	10 48	20
24	19 47	19 18	18 44	18 31	18 09	17 46	17 23	16 59	16 36	16 14	15 57	15 34	24
28	26 55	26 16	25 45	25 14	24 42	24 10	23 39	23 08	22 37	22 05	21 41	21 10	28
32	35 09	34 18	33 38	32 57	32 15	31 34	30 53	30 13	29 32	28 50	28 19	27 38	32
36	44 30	43 25	42 33	41 41	40 50	39 58	39 06	38 14	37 22	36 31	35 52	35 00	36
40	54 56	53 36	52 32	51 28	50 24	49 20	48 16	47 12	46 08	45 04	44 16	43 12	40
44	66 28	64 51	63 34	62 16	60 59	59 42	58 24	59 07	55 49	54 32	53 34	52 17	44
48	79 06	77 11	75 39	74 07	72 34	71 02	69 30	67 56	66 24	64 53	63 44	62 12	48
52	92 50	90 35	88 47	86 59	85 10	83 22	81 34	79 46	77 58	76 09	74 48	73 00	52
56	...	...	...	...	98 47	96 42	94 36	92 31	90 25	88 20	86 46	84 11	56
60	...	...	...	...	...	...	...	...	103 48	101 24	99 36	97 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.06	2.01	1.97	1.93	1.89	1.85	1.81	1.77	1.73	1.69	1.66	1.62	△₁h
Log.	0.313 87	0.303 20	0.294 47	0.285 56	0.276 46	0.267 17	0.257 68	0.247 97	0.238 05	0.227 89	0.220 11	0.209 52	Log.
Limit	49	50	51	52	53	53	54	54	55	56	57	58	Minutes
Meridian	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 25	0 24	0 23	0 23	0 22	0 22	0 22	0 21	0 21	0 20	0 20	4
8	1 41	1 39	1 37	1 36	1 34	1 31	1 29	1 27	1 25	1 23	1 21	1 20	8
12	3 48	3 43	3 39	3 35	3 31	3 25	3 20	3 16	3 11	3 07	3 03	2 59	12
16	6 44	6 37	6 29	6 21	6 13	6 03	5 56	5 48	5 41	5 33	5 25	5 17	16
20	10 32	10 20	10 08	9 56	9 44	9 28	9 16	9 04	8 52	8 40	8 28	8 16	20
24	15 10	14 53	14 36	14 18	14 01	13 38	13 21	13 04	12 46	12 29	12 11	11 54	24
28	20 39	20 15	19 52	19 29	19 05	18 34	18 10	17 46	17 23	16 59	16 36	16 12	28
32	26 58	26 27	25 56	25 26	24 55	24 14	23 43	23 12	22 42	22 11	21 41	21 10	32
36	34 08	33 29	32 50	32 11	31 32	30 40	30 02	29 23	28 44	28 05	27 26	26 47	36
40	42 08	41 20	40 32	39 44	38 56	37 52	37 04	36 16	35 28	34 40	33 52	33 04	40
44	50 59	50 01	49 03	48 04	47 06	45 49	44 51	43 53	42 55	41 57	40 59	40 00	44
48	60 40	59 31	58 22	57 13	56 04	54 32	53 22	52 13	51 04	49 55	48 46	47 37	48
52	71 12	69 51	68 30	67 09	65 48	64 00	62 38	61 17	59 56	58 35	57 14	55 53	52
56	82 35	81 01	79 27	77 52	76 18	74 13	72 39	71 05	69 31	67 57	66 23	64 48	56
60	94 48	93 00	91 12	89 24	87 36	85 12	83 24	81 36	79 48	78 00	76 12	74 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.58	1.55	1.52	1.49	1.46	1.42	1.39	1.36	1.33	1.30	1.27	1.24	△₁h
Log.	0.198 66	0.190 33	0.181 84	0.173 19	0.164 35	0.152 29	0.143 01	0.133 54	0.123 85	0.113 94	0.103 80	0.093 42	Log.
Limit	59	60	61	62	63	64	65	66	67	67	68	69	Minutes
Meridian	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 19	0 18	0 17	0 17	0 16	0 15	0 15	0 15	...	4
8	1 17	1 15	1 14	1 12	1 10	1 08	1 07	1 04	1 03	1 01	0 59	...	8
12	2 54	2 50	2 47	2 42	2 38	2 34	2 30	2 25	2 23	2 19	2 14	...	12
16	5 10	5 02	4 57	4 50	4 42	4 34	4 26	4 19	4 13	4 05	3 58	...	16
20	8 04	7 52	7 44	7 32	7 20	7 08	6 56	6 44	6 36	6 24	6 12	...	20
24	11 37	11 20	11 09	10 51	10 34	10 16	9 59	9 42	9 30	9 13	8 55	...	24
28	15 49	15 25	15 09	14 46	14 22	13 59	13 35	13 12	12 57	12 33	12 10	...	28
32	20 39	20 08	19 47	19 17	18 46	18 16	17 45	17 14	16 54	16 23	15 53	...	32
36	26 08	25 30	25 04	24 25	23 46	23 07	22 28	21 49	21 23	20 44	20 05	...	36
40	32 16	31 28	30 56	30 08	29 20	28 32	27 44	26 56	26 24	25 36	24 48	...	40
44	39 02	38 05	37 26	36 28	35 30	34 32	33 33	32 35	31 56	30 58	30 00	...	44
48	46 28	45 18	44 52	43 23	42 14	41 05	39 56	38 47	38 01	36 52	35 43	...	48
52	54 32	53 10	52 16	50 55	49 34	48 13	46 52	45 31	44 37	43 16	41 55	...	52
56	63 14	61 41	60 38	59 04	57 30	55 56	54 21	52 47	51 44	50 10	48 36	...	56
60	72 36	70 48	69 36	67 48	66 00	64 12	62 24	60 36	59 24	57 36	55 48	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.21	1.18	1.16	1.13	1.10	1.07	1.04	1.01	0.99	0.96	0.93	...	$\Delta_1 h$
Log.	0.082 79	0.071 88	0.064 46	0.053 08	0.041 39	0.029 38	0.017 03	0.004 32	9.995 64	9.982 27	9.968 48	... ...	Log.
Limit	70	71	73	74	75	76	77	78	79	80	81		Minutes
Meridian	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	0 11	0 10	0 10	0 09	4
8	...	...	...	...	...	...	...	...	0 41	0 39	0 38	0 37	8
12	...	...	...	...	...	...	...	...	1 33	1 29	1 26	1 24	12
16	...	...	...	...	...	...	...	...	2 47	2 39	2 34	2 28	16
20	...	...	...	...	...	...	...	...	4 20	4 08	4 00	3 52	20
24	...	...	...	...	...	...	...	...	6 15	5 58	5 46	5 32	24
28	...	...	...	...	...	...	...	...	8 29	8 06	7 50	7 35	28
32	...	...	...	...	...	...	...	...	11 05	10 34	10 14	9 54	32
36	...	...	...	...	...	...	...	...	14 03	13 24	12 58	12 32	36
40	...	...	...	...	...	...	...	...	17 20	16 32	16 00	15 28	40
44	...	...	...	...	...	...	...	...	20 59	20 01	19 22	18 43	44
48	...	...	...	...	...	...	...	...	24 57	23 48	23 02	22 16	48
52	...	...	...	...	...	...	...	...	29 17	27 56	27 02	26 09	52
56	...	...	...	...	...	...	...	...	33 59	32 25	31 22	30 19	56
60	...	...	...	...	...	...	...	...	39 00	37 12	36 00	34 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	...	...	...	...	...	0.65	0.62	0.60	0.58	$\Delta_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.812 91	9.792 39	9.778 15	9.763 43	Log.
Limit									90	91	91	92	Minutes
Meridian	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	Altitudes

Latitude 28° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 59	1 01	1 03	1 06	1 08	1 10	1 14	1 17	1 20	1 24	1 28	1 33	4
8	3 56	4 05	4 12	4 22	4 32	4 43	4 54	5 07	5 21	5 37	5 54	6 12	8
12	8 51	9 10	9 29	9 50	10 12	10 37	11 02	11 31	12 03	12 38	13 16	13 58	12
16	15 45	16 18	16 51	17 30	18 08	18 51	19 38	20 29	21 25	22 26	23 36	24 50	16
20	24 36	25 28	26 20	27 20	28 20	29 28	30 40	32 00	33 28	35 04	36 52	38 48	20
24	35 26	36 41	37 55	39 22	40 48	42 26	44 10	46 05	48 12	50 30	53 05	55 53	24
28	48 13	49 55	51 37	53 34	55 32	57 46	60 06	62 43	65 36	68 44	72 16	76 03	28
32	62 58	65 11	67 25	69 58	72 32	75 26	78 30	81 55	...	...	...	...	32
36	79 43	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.69	3.82	3.95	4.10	4.25	4.42	4.60	4.80	5.02	5.26	5.53	5.82	$\triangle_1 h$
Log.	0.567 03	0.582 06	0.596 60	0.612 78	0.628 39	0.645 42	0.662 76	0.681 24	0.700 70	0.720 99	0.742 73	0.764 92	Log.
Limit	31	31	30	29	28	28	27	26	25	24	23	22	Minutes
Meridian	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 39	1 44	1 51	1 59	2 08	2 19	2 32	2 47	3 07	3 52	4 06	4 53	4
8	6 33	6 58	7 24	7 57	8 33	9 16	10 08	11 11	12 30	14 10	16 24	19 32	8
12	14 45	15 40	16 41	17 52	19 13	20 51	22 48	25 10	28 06	31 53	36 55	...	12
16	26 15	27 52	29 39	31 44	34 13	37 05	40 32	44 42	...	...	...	...	16
20	41 00	43 32	46 20	49 36	53 28	57 56	...	...	...	...	...	...	20
24	59 03	62 41	66 43	...	...	...	...	...	...	...	...	...	24
28	80 21	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.15	6.53	6.95	7.44	8.02	8.69	9.50	10.48	11.71	13.28	15.38	18.31	$\triangle_1 h$
Log.	0.788 88	0.814 91	0.841 98	0.871 57	0.904 17	0.939 02	0.977 72	1.020 36	1.068 56	1.123 20	1.186 96	1.262 69	Log.
Limit	21	20	19	18	17	16	15	14	12	11	10	9	Minutes
Meridian	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	35°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	...	4 27	3 40	3 06	4
8	...	...	...	...	...	...	...	...	...	17 24	14 40	12 25	8
12	...	...	...	...	...	...	...	...	...	40 02	33 00	27 57	12
16	...	...	...	...	...	...	...	...	...	...	...	49 43	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	...	...	16.68	13.75	11.65	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.222 20	1.138 30	1.066 33	Log.
Limit	7	5	4	2	0	2	3	5	7	9	11	12	Minutes
Meridian	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 41	2 22	2 06	1 53	1 42	1 33	1 25	1 18	1 12	1 07	1 02	0 58	4
8	10 45	9 26	8 24	7 32	6 49	6 12	5 41	5 13	4 49	4 29	4 09	3 52	8
12	24 12	21 14	18 53	16 57	15 20	13 58	12 47	11 46	10 51	10 05	9 22	8 42	12
16	43 00	37 46	33 35	30 07	27 16	24 50	22 45	20 54	19 17	17 55	16 38	15 30	16
20	...	59 00	52 28	47 04	42 36	38 48	35 32	32 40	30 08	28 00	26 00	24 12	20
24	...	...	...	67 47	61 21	55 53	51 10	47 02	43 24	40 19	37 26	34 51	24
28	...	...	...	...	...	76 03	69 39	64 02	59 04	54 53	50 58	47 26	28
32	...	...	...	...	...	...	...	...	77 08	71 41	66 34	61 57	32
36	...	...	...	...	...	...	...	...	...	...	...	78 25	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	10.08	8.85	7.87	7.06	6.39	5.82	5.33	4.90	4.52	4.20	3.90	3.63	$\triangle_1 h$
Log.	1.003 46	0.946 94	0.895 97	0.848 80	0.805 50	0.764 92	0.726 73	0.690 20	0.655 14	0.623 25	0.591 06	0.559 91	Log.
Limit	14	16	18	19	20	22	24	25	26	27	28	29	Minutes
Meridian	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	Altitudes

Latitude 28° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 54	0 51	0 47	0 44	0 42	0 39	0 37	0 35	0 33	0 31	0 30	0 27	4
8	3 37	3 23	3 10	2 59	2 47	2 39	2 28	2 20	2 11	2 04	1 58	1 51	8
12	8 08	7 36	7 08	6 42	6 17	5 56	5 34	5 15	4 57	4 41	4 25	4 09	12
16	14 28	13 32	12 40	11 54	11 11	10 32	9 54	9 21	8 47	8 19	7 51	7 23	16
20	22 36	21 08	19 48	18 36	17 28	16 28	15 28	14 36	13 44	13 00	12 16	11 32	20
24	32 33	30 26	28 30	26 47	25 10	23 42	22 17	21 02	19 47	18 43	17 40	16 36	24
28	44 18	41 25	38 49	36 28	34 14	32 17	30 19	28 37	26 55	25 29	24 02	22 37	28
32	57 51	54 06	50 42	47 37	44 42	42 10	39 35	37 22	35 09	33 17	31 24	29 32	32
36	73 14	68 29	64 09	60 16	56 36	53 21	50 07	47 19	44 30	42 07	39 45	37 22	36
40	...	...	79 12	74 24	69 52	65 52	61 52	58 24	54 56	52 00	49 09	46 08	40
44	...	...	...	...	84 33	79 42	74 52	70 40	66 28	62 55	59 22	55 49	44
48	...	...	...	...	...	...	89 05	84 05	79 06	74 53	70 39	66 24	48
52	...	...	...	...	...	...	...	...	...	87 53	82 55	77 58	52
56	...	...	...	...	...	...	...	...	...	...	...	90 25	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.39	3.17	2.97	2.79	2.62	2.47	2.32	2.19	2.06	1.95	1.84	1.73	$\triangle_1$h
Log.	0.530 20	0.501 06	0.472 76	0.445 60	0.418 30	0.392 70	0.365 49	0.340 44	0.313 87	0.290 03	0.264 82	0.238 05	Log.
Limit	31	32	33	34	36	37	39	40	41	42	44	46	Minutes
Meridian	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 25	0 23	0 22	0 20	0 19	0 19	0 17	0 16	0 15	0 14	0 13	4
8	1 45	1 39	1 34	1 28	1 23	1 17	1 13	1 08	1 04	1 01	0 57	0 53	8
12	3 56	3 42	3 31	3 17	3 06	2 54	2 44	2 34	2 25	2 17	2 08	1 59	12
16	7 00	6 34	6 13	5 51	5 30	5 10	4 52	4 34	4 19	4 03	3 48	3 33	16
20	10 56	10 16	9 44	9 08	8 36	8 04	7 36	7 08	6 44	6 20	5 56	5 32	20
24	15 45	14 47	14 01	13 09	12 23	11 37	10 57	10 16	9 42	9 07	8 33	7 58	24
28	21 25	20 07	19 05	17 54	16 52	15 49	14 53	13 59	13 12	12 25	11 38	10 51	28
32	27 59	26 17	24 55	23 23	22 01	20 39	19 27	18 16	17 14	16 13	15 11	14 10	32
36	35 26	33 16	31 32	29 36	27 52	26 08	24 38	23 07	21 49	20 31	19 14	17 56	36
40	43 44	41 04	38 56	36 32	34 24	32 16	30 24	28 32	26 56	25 20	23 44	22 08	40
44	52 55	49 41	46 06	44 13	41 37	39 02	36 47	34 32	32 35	30 39	28 43	26 47	44
48	62 58	59 08	56 04	52 36	49 32	46 28	43 46	41 05	38 47	36 29	34 10	31 52	48
52	73 54	69 24	65 48	61 44	58 08	54 32	51 22	48 13	45 31	42 49	40 06	37 24	52
56	85 43	80 29	78 18	71 37	67 25	63 14	59 35	55 56	52 47	49 39	46 31	43 23	56
60	...	92 24	87 36	82 12	77 24	72 36	68 24	64 12	60 36	57 00	53 24	49 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.64	1.54	1.46	1.37	1.29	1.21	1.14	1.07	1.01	0.95	0.89	0.83	$\triangle_1$h
Log.	0.214 84	0.187 52	0.164 35	0.136 72	0.110 59	0.082 79	0.056 90	0.029 38	0.004 32	9.977 72	9.949 39	9.919 08	Log.
Limit	48	50	52	54	56	57	58	60	62	64	66	68	Minutes
Meridian	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	Altitudes

Latitude 28° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 59	0 57	0 55	0 54	0 52	0 51	0 49	0 48	0 46	0 46	0 44	0 43	4
8	3 56	3 49	3 43	3 35	3 29	3 23	3 17	3 12	3 06	3 02	2 58	2 53	8
12	8 51	8 36	8 20	8 04	7 50	7 36	7 24	7 12	7 01	6 50	6 39	6 29	12
16	15 45	15 16	14 48	14 20	13 54	13 32	13 08	12 48	12 27	12 10	11 49	11 31	16
20	24 36	23 52	23 08	22 24	21 44	21 08	20 32	20 00	19 28	19 00	18 28	18 00	20
24	35 26	34 22	33 18	32 16	31 18	30 26	29 34	28 48	28 02	27 22	26 35	25 55	24
28	48 13	46 47	45 21	43 54	42 36	41 25	40 15	39 12	38 10	37 14	36 12	35 17	28
32	62 58	61 06	59 14	57 20	55 38	54 06	52 34	51 12	49 50	48 38	47 17	46 05	32
36	79 43	77 20	74 57	72 35	70 25	68 29	66 32	64 48	63 04	61 34	59 50	58 19	36
40	...	...	92 32	89 36	86 56	84 32	82 08	80 00	77 52	76 00	73 52	72 00	40
44	...	...	...	...	...	...	...	...	...	...	...	87 07	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.69	3.58	3.47	3.36	3.26	3.17	3.08	3.00	2.92	2.85	2.77	2.70	$\triangle_1 h$
Log.	0.567 03	0.553 88	0.540 33	0.526 34	0.513 22	0.501 06	0.488 55	0.477 12	0.465 38	0.454 84	0.442 48	0.431 36	Log.
Limit	31	33	33	34	35	35	36	36	37	38	38	39	Minutes
Meridian	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 41	0 40	0 39	0 38	0 38	0 36	0 36	0 35	0 35	0 34	0 33	4
8	2 49	2 45	2 41	2 38	2 34	2 30	2 27	2 24	2 20	2 17	2 14	2 11	8
12	6 20	6 10	6 01	5 55	5 46	5 37	5 30	5 23	5 15	5 08	5 02	4 55	12
16	11 16	10 58	10 43	10 29	10 14	9 59	9 46	9 33	9 21	9 08	8 58	8 45	16
20	17 36	17 08	16 44	16 24	16 00	15 36	15 16	14 56	14 36	14 16	14 00	13 40	20
24	25 21	24 40	24 06	23 37	23 02	22 28	21 59	21 30	21 02	20 33	20 10	19 41	24
28	34 29	33 35	32 48	32 09	31 22	30 34	29 56	29 16	28 37	27 57	27 26	26 47	28
32	45 03	43 52	42 50	41 59	40 58	39 56	39 05	38 14	37 22	36 31	35 50	34 59	32
36	57 02	55 31	54 13	53 08	51 50	50 33	49 28	48 23	47 19	46 14	45 22	44 17	36
40	70 24	68 32	66 56	65 36	64 00	62 24	61 04	59 44	58 24	57 04	56 00	54 40	40
44	85 11	82 56	80 59	79 22	77 26	75 30	73 53	72 16	70 40	69 03	67 46	66 09	44
48	...	...	96 23	94 28	92 10	89 51	87 56	86 01	84 05	82 10	80 38	78 43	48
52	...	...	...	...	...	105 27	103 12	100 57	98 41	96 26	94 38	92 23	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.64	2.57	2.51	2.46	2.40	2.34	2.29	2.24	2.19	2.14	2.10	2.05	$\triangle_1 h$
Log.	0.421 60	0.409 93	0.399 67	0.390 94	0.380 21	0.369 22	0.359 84	0.350 25	0.340 44	0.330 41	0.322 22	0.311 75	Log.
Limit	40	41	42	43	43	44	44	45	46	47	48	49	Minutes
Meridian	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	Altitudes

Latitude 28° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 32	0 31	0 30	0 30	0 30	0 29	0 28	0 27	0 27	0 27	0 26	0 25	4
8	2 09	2 05	2 02	2 01	1 58	1 56	1 54	1 51	1 49	1 46	1 42	1 42	8
12	4 49	4 43	4 37	4 32	4 26	4 20	4 16	4 09	4 05	3 59	3 54	3 49	12
16	8 35	8 21	8 11	8 04	7 54	7 44	7 33	7 23	7 15	7 05	6 58	6 47	16
20	13 24	13 04	12 48	12 36	12 20	12 04	11 48	11 32	11 20	11 04	10 52	10 36	20
24	19 18	18 49	18 26	18 09	17 46	17 23	16 59	16 36	16 19	15 57	15 39	15 16	24
28	26 16	25 37	25 06	24 42	24 10	23 39	23 08	22 37	22 13	21 41	21 18	20 47	28
32	34 18	33 27	32 46	32 15	31 34	30 53	30 13	29 32	29 01	28 19	27 49	27 08	32
36	43 25	42 20	41 28	40 50	39 58	39 06	38 14	37 22	36 43	35 52	35 13	34 21	36
40	53 36	52 16	51 12	50 24	49 20	48 16	47 12	46 08	45 20	44 16	43 28	42 24	40
44	64 51	63 14	61 57	60 59	59 42	58 24	57 07	55 49	54 51	53 34	52 36	51 18	44
48	77 11	75 16	73 44	72 34	71 02	69 30	67 56	66 24	65 15	63 44	62 35	61 03	48
52	90 35	88 20	86 32	85 10	83 22	81 34	79 46	77 58	76 37	74 48	73 27	71 39	52
56	105 03	102 26	100 21	98 47	96 42	94 36	92 31	90 25	88 51	86 46	85 12	83 06	56
60	120 36	117 36	115 12	113 24	111 00	108 36	106 12	103 48	102 00	99 36	97 48	95 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.01	1.96	1.92	1.89	1.85	1.81	1.77	1.73	1.70	1.66	1.63	1.59	$\triangle_1 h$
Log.	0.303 20	0.292 26	0.283 30	0.276 46	0.267 17	0.257 68	0.247 97	0.238 05	0.230 45	0.220 11	0.212 19	0.201 40	Log.
Limit	49	51	52	53	53	54	55	55	56	57	58	59	Minutes
Meridian	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 24	0 24	0 23	0 22	0 22	0 22	0 22	0 21	0 20	0 20	0 19	4
8	1 40	1 38	1 36	1 34	1 32	1 30	1 28	1 26	1 24	1 22	1 20	1 18	8
12	3 45	3 40	3 36	3 31	3 24	3 22	3 17	3 13	3 08	3 05	3 00	2 56	12
16	6 39	6 32	6 24	6 13	6 06	5 58	5 51	5 43	5 36	5 27	5 20	5 12	16
20	10 24	10 12	10 00	9 44	9 32	9 20	9 08	8 56	8 44	8 32	8 20	8 08	20
24	14 59	14 41	14 24	14 01	13 43	13 26	13 09	12 52	12 35	12 17	12 00	11 43	24
28	20 23	20 00	19 36	19 05	18 42	18 18	17 54	17 30	17 07	16 44	16 20	15 57	28
32	26 37	26 07	25 36	24 55	24 25	23 54	23 23	22 52	22 21	21 51	21 20	20 49	32
36	33 42	33 03	32 24	31 32	30 53	30 14	29 36	28 57	28 18	27 39	27 00	26 21	36
40	41 36	40 48	40 00	38 56	38 08	37 20	36 32	35 44	34 56	34 08	33 20	32 32	40
44	50 20	49 22	48 24	47 06	46 08	45 10	44 13	43 14	42 16	41 18	40 20	39 12	44
48	59 24	58 45	57 36	56 04	54 55	53 46	52 36	51 27	50 18	49 09	48 00	46 51	48
52	70 18	68 57	67 36	65 48	64 27	63 06	61 44	60 23	59 02	57 41	56 20	54 59	52
56	81 32	79 58	78 24	76 18	74 44	73 10	71 37	70 02	68 28	66 54	65 20	63 46	56
60	93 36	91 48	90 00	87 36	85 48	84 00	82 12	80 24	78 36	76 48	75 00	73 12	50
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.56	1.53	1.50	1.46	1.43	1.40	1.37	1.34	1.31	1.28	1.25	1.22	$\triangle_1 h$
Log.	0.193 12	0.184 69	0.176 09	0.164 35	0.155 34	0.146 13	0.136 72	0.127 10	0.117 27	0.107 21	0.096 91	0.086 36	Log.
Limit	60	61	62	63	64	65	66	67	68	68	69	70	Minutes
Meridian	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 18	0 17	0 17	0 17	0 16	0 15	0 15	...	...	4
8	1 17	1 15	1 13	1 11	1 10	1 08	1 06	1 04	1 02	1 01	...	...	8
12	2 53	2 48	2 44	2 39	2 37	2 33	2 28	2 24	2 22	2 17	...	...	12
16	5 07	5 00	4 52	4 45	4 39	4 31	4 24	4 16	4 10	4 03	...	...	16
20	8 00	7 48	7 36	7 24	7 16	7 04	6 52	6 40	6 32	6 20	...	...	20
24	11 31	11 14	10 57	10 40	10 28	10 11	9 53	9 36	9 24	9 07	...	...	24
28	15 41	15 17	14 53	14 30	14 15	13 51	13 28	13 04	12 49	12 25	...	...	28
32	20 29	19 58	19 27	18 56	18 36	18 05	17 35	17 04	16 44	16 13	...	...	32
36	25 55	25 17	24 38	23 59	23 33	22 54	22 15	21 36	21 10	20 31	...	...	36
40	32 00	31 12	30 24	29 36	29 04	28 16	27 28	26 40	26 08	25 20	...	...	40
44	38 43	37 46	36 47	35 49	35 10	34 12	33 14	32 16	31 37	30 29	...	...	44
48	46 05	44 55	43 46	42 37	41 51	40 42	39 33	38 24	37 38	36 29	...	...	48
52	54 05	52 43	51 22	50 01	49 07	47 46	46 25	45 04	44 10	42 49	...	...	52
56	62 43	61 10	59 35	58 01	56 58	55 24	53 50	52 16	51 13	49 39	...	...	56
60	72 00	70 12	68 24	66 36	65 24	63 36	61 48	60 00	58 48	57 00	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.20	1.17	1.14	1.11	1.09	1.06	1.03	1.00	0.98	0.95	...	...	$\triangle_1 h$
Log.	0.079 18	0.068 19	0.056 90	0.045 32	0.037 43	0.025 31	0.012 84	0.00 ...	9.991 20	9.977 72	... ...	... ...	Log.
Limit	71	72	73	74	75	76	78	79	80	81			Minutes
Meridian	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	0 11	0 11	0 10	0 10	0 09	4
8	...	...	...	...	...	...	...	0 43	0 41	0 39	0 38	0 37	8
12	...	...	...	...	...	...	...	1 37	1 33	1 29	1 26	1 24	12
16	...	...	...	...	...	...	...	2 54	2 47	2 39	2 34	2 28	16
20	...	...	...	...	...	...	...	4 32	4 20	4 08	4 00	3 52	20
24	...	...	...	...	...	...	...	6 32	6 15	5 58	5 46	5 32	24
28	...	...	...	...	...	...	...	8 53	8 29	8 06	7 50	7 35	28
32	...	...	...	...	...	...	...	11 36	11 05	10 34	10 14	9 54	32
36	...	...	...	...	...	...	...	14 42	14 03	13 24	12 58	12 32	36
40	...	...	...	...	...	...	...	18 08	17 20	16 32	16 00	15 28	40
44	...	...	...	...	...	...	...	21 57	20 59	20 01	19 22	18 43	44
48	...	...	...	...	...	...	...	26 06	24 57	23 48	23 02	22 16	48
52	...	...	...	...	...	...	...	30 38	29 17	27 56	27 02	26 09	52
56	...	...	...	...	...	...	...	35 33	33 59	32 25	31 22	30 19	56
60	...	...	...	...	...	...	...	40 48	39 00	37 12	36 00	34 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	0.68	0.65	0.62	0.60	0.58	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.832 51	9.812 91	9.792 39	9.778 15	9.763 43	Log.
Limit								89	89	90	91	92	Minutes
Meridian	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	Altitudes

Latitude 29° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 57	0 59	1 00	1 02	1 05	1 07	1 10	1 13	1 16	1 19	1 23	1 27	4
8	3 47	3 54	4 02	4 10	4 19	4 30	4 40	4 51	5 04	5 17	5 32	5 50	8
12	8 30	8 47	9 05	9 23	9 43	10 06	10 29	10 55	11 24	11 55	12 27	13 07	12
16	15 06	15 37	16 07	16 41	17 17	17 58	18 39	19 25	20 16	21 09	22 09	23 17	16
20	23 36	24 24	25 12	26 04	27 00	28 04	29 08	30 20	31 40	33 04	34 36	36 24	20
24	33 59	35 09	36 17	37 32	38 53	40 25	41 57	43 41	45 36	47 37	49 50	52 25	24
28	46 15	47 49	49 24	51 06	52 55	55 01	57 06	59 27	62 02	64 49	67 49	71 21	28
32	60 25	62 27	64 31	66 44	69 07	71 51	74 34	77 39	81 04	...	...	...	32
36	76 28	79 04	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.54	3.66	3.78	3.91	4.05	4.21	4.37	4.55	4.75	4.96	5.19	5.46	$\triangle_1$h
Log.	0.549 00	0.563 48	0.577 49	0.592 18	0.607 46	0.624 28	0.640 48	0.658 01	0.676 69	0.695 48	0.715 17	0.737 19	Log.
Limit	32	31	30	29	29	28	28	27	26	25	24	24	Minutes
Meridian	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 32	1 37	1 43	1 50	1 58	2 06	2 17	2 30	2 45	3 04	3 29	4 02	4
8	6 08	6 29	6 53	7 19	7 50	8 25	9 08	9 58	11 00	12 17	13 57	16 07	8
12	13 48	14 34	15 28	16 28	17 37	18 58	20 23	22 26	24 46	27 39	31 22	36 17	12
16	24 32	25 54	27 28	29 16	31 19	33 42	36 31	39 54	44 02	...	...	...	16
20	38 20	40 28	42 56	45 44	48 56	52 40	57 04	...	...	...	...	...	20
24	55 12	58 16	61 49	65 52	...	...	...	...	...	...	...	...	24
28	75 08	79 19	84 09	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	5.75	6.07	6.44	6.86	7.34	7.90	8.56	9.35	10.32	11.52	13.07	15.12	$\triangle_1$h
Log.	0.759 67	0.783 19	0.808 89	0.836 32	0.865 70	0.897 63	0.932 47	0.970 81	1.013 68	1.061 45	1.116 28	1.179 55	Log.
Limit	23	22	21	20	19	18	17	16	14	13	12	10	Minutes
Meridian	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	4 48	...	...	...	...	...	...	...	...	...	4 22	3 35	4
8	19 12	...	...	...	...	...	...	...	...	...	17 26	14 21	8
12	...	...	...	...	...	...	...	...	...	...	39 51	32 17	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	18.00	...	...	...	...	...	...	...	...	...	16.34	13.45	△₁h
Log.	1.255 27	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.213 25	1.128 72	Log.
Limit	8	6	5	4	2	0	2	4	6	8	9	10	Minutes
Meridian	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 02	2 28	2 19	2 03	1 50	1 39	1 31	1 23	1 16	1 10	1 05	1 00	4
8	12 10	10 30	9 13	8 12	7 21	6 39	6 03	5 32	5 06	4 43	4 21	4 03	8
12	27 22	23 38	20 45	18 27	16 34	14 57	13 36	12 27	11 27	10 35	9 48	9 06	12
16	28 06	42 02	36 55	32 49	29 26	26 35	24 12	22 09	20 21	18 49	17 24	16 10	16
20	...	...	...	51 16	46 00	41 32	37 48	34 36	31 48	29 24	27 12	25 16	20
24	...	...	...	...	...	59 48	54 26	49 50	45 47	42 20	39 10	36 23	24
28	...	...	...	...	...	...	...	67 49	62 18	57 38	53 19	49 32	28
32	...	...	...	...	...	...	...	...	...	75 16	69 38	64 41	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	11.40	9.85	8.65	7.69	6.90	6.23	5.67	5.19	4.77	4.41	4.08	3.79	△₁h
Log.	1.056 90	0.993 44	0.937 02	0.885 93	0.838 85	0.794 49	0.753 58	0.715 17	0.678 52	0.644 44	0.610 66	0.578 64	Log.
Limit	12	14	15	16	18	20	21	23	25	26	27	28	Minutes
Meridian	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	Altitudes

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Latitude 29° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 56	0 52	0 49	0 46	0 43	0 41	0 38	0 36	0 34	0 31	0 30	0 28	4
8	3 46	3 31	3 17	3 05	2 54	2 43	2 33	2 24	2 15	2 07	2 00	1 54	8
12	8 28	7 54	7 24	6 56	6 30	6 06	5 44	5 24	5 03	4 47	4 31	4 16	12
16	15 04	14 02	13 08	12 20	11 34	10 50	10 12	9 36	9 01	8 29	8 01	7 33	16
20	23 32	21 56	20 32	19 16	18 04	16 56	15 56	15 00	14 04	13 16	12 32	11 48	20
24	33 53	31 35	29 34	27 45	26 01	24 23	22 57	21 36	21 16	19 06	18 03	16 59	24
28	46 08	43 00	40 15	37 46	35 25	33 11	31 14	29 24	27 34	26 01	24 34	23 08	28
32	60 15	56 09	52 34	49 19	46 15	43 21	40 47	38 24	36 00	33 58	32 05	30 13	32
36	76 15	71 04	66 32	62 26	58 22	54 52	51 38	48 36	45 35	42 59	40 37	38 14	36
40	...	...	...	77 04	72 16	67 44	63 44	60 00	56 16	53 04	50 08	47 12	40
44	...	...	...	...	...	81 57	77 07	72 36	68 05	64 12	60 40	57 07	44
48	...	...	...	...	...	...	...	...	81 01	76 25	72 11	67 56	48
52	...	...	...	...	...	...	...	...	...	...	84 43	79 46	52
56	...	...	...	...	...	...	...	...	...	...	...	92 31	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.53	3.29	3.08	2.89	2.71	2.54	2.39	2.25	2.11	1.99	1.88	1.77	$\triangle_1$h
Log.	0.547 77	0.517 20	0.488 55	0.460 90	0.432 97	0.404 83	0.378 40	0.352 18	0.324 28	0.298 85	0.274 16	0.247 97	Log.
Limit	30	31	32	33	35	36	37	38	39	41	43	45	Minutes
Meridian	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 25	0 23	0 22	0 21	0 19	0 19	0 17	0 16	0 15	0 14	0 13	4
8	1 47	1 41	1 35	1 29	1 23	1 19	1 14	1 10	1 05	1 01	0 57	0 52	8
12	4 00	3 46	3 34	3 20	3 08	2 57	2 47	2 37	2 27	2 19	2 08	1 58	12
16	7 08	6 42	6 18	5 56	5 36	5 15	4 57	4 39	4 21	4 05	3 48	3 30	16
20	11 08	10 28	9 52	9 16	8 44	8 12	7 44	7 16	6 48	6 24	5 56	5 28	20
24	16 02	15 04	14 12	13 21	12 35	11 48	11 09	10 28	9 48	9 13	8 33	7 53	24
28	21 49	20 31	19 21	18 10	17 07	16 05	15 09	14 15	13 20	12 33	11 38	10 43	28
32	28 30	26 48	25 16	23 43	22 21	21 00	19 47	18 36	17 24	16 23	15 11	13 59	32
36	36 05	33 55	31 58	30 02	28 18	26 34	25 04	23 33	22 02	20 44	19 14	17 43	36
40	44 32	41 52	39 28	37 04	34 56	32 48	30 56	29 04	27 12	25 36	23 44	21 52	40
44	53 54	50 40	47 45	44 51	42 16	39 41	37 26	35 10	32 55	30 58	28 43	26 28	44
48	64 07	60 17	56 50	53 22	50 18	47 14	44 32	41 51	39 10	36 52	34 10	31 29	48
52	75 15	70 45	66 42	62 38	59 02	55 26	52 16	49 07	45 58	43 16	40 06	36 57	52
56	87 18	82 04	77 21	72 39	68 28	64 17	60 38	56 58	53 19	50 10	46 31	42 52	56
60	...	...	88 48	83 24	78 36	73 48	69 36	65 24	61 12	57 36	53 24	49 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.67	1.57	1.48	1.39	1.31	1.23	1.16	1.09	1.02	0.96	0.89	0.82	$\triangle_1$h
Log.	0.222 72	0.195 90	0.170 26	0.143 01	0.117 27	0.089 91	0.064 46	0.037 43	0.008 60	9.982 27	9.949 39	9.913 81	Log.
Limit	47	49	50	52	54	56	58	60	62	64	66	68	Minutes
Meridian	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 57	0 54	0 53	0 52	0 51	0 49	0 47	0 46	0 45	0 44	0 43	0 42	4
8	3 47	3 40	3 33	3 28	3 21	3 16	3 10	3 05	3 01	2 57	2 52	2 47	8
12	8 30	8 14	7 59	7 47	7 33	7 21	7 10	6 58	6 47	6 38	6 27	6 17	12
16	15 06	14 38	14 31	13 49	13 27	13 03	12 42	12 22	12 05	11 46	11 29	11 11	16
20	23 36	22 52	22 12	21 36	21 00	20 24	19 52	19 20	18 52	18 24	17 56	17 28	20
24	33 59	32 55	31 58	31 06	30 15	29 23	28 36	27 50	27 10	26 30	25 50	25 10	24
28	46 15	44 50	43 31	42 20	41 09	39 59	38 57	37 54	36 59	36 04	35 09	34 14	28
32	60 25	58 33	56 50	55 18	53 45	52 13	50 52	49 30	48 18	47 06	45 54	44 42	32
36	76 28	74 05	71 56	69 59	68 03	66 06	64 22	62 38	61 08	59 37	58 07	56 36	36
40	...	91 28	88 48	86 24	84 00	81 36	79 28	77 20	75 28	73 36	71 44	69 52	40
44	...	...	...	...	...	...	...	...	...	...	86 48	84 33	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.54	3.43	3.33	3.24	3.15	3.06	2.98	2.90	2.83	2.76	2.69	2.62	$\triangle_1$h
Log.	0.549 00	0.535 29	0.522 44	0.510 55	0.498 31	0.485 72	0.474 22	0.462 40	0.451 79	0.440 91	0.429 75	0.418 30	Log.
Limit	32	33	33	34	35	36	37	37	38	39	39	40	Minutes
Meridian	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 41	0 40	0 39	0 38	0 37	0 36	0 35	0 35	0 35	0 33	0 33	0 32	4
8	2 44	2 40	2 37	2 33	2 29	2 26	2 23	2 19	2 17	2 14	2 11	2 09	8
12	6 09	6 00	5 52	5 44	5 35	5 29	5 21	5 14	5 08	5 01	4 55	4 49	12
16	10 55	10 40	10 24	10 12	9 57	9 43	9 31	9 18	9 08	8 55	8 45	8 35	16
20	17 04	16 40	16 16	15 56	15 32	15 12	14 52	14 32	14 16	13 56	13 40	13 24	20
24	24 35	24 00	23 25	22 57	22 22	21 53	21 24	20 56	20 33	20 04	19 41	19 18	24
28	33 27	32 40	31 53	31 14	30 27	29 48	29 09	28 29	27 57	27 19	26 47	26 16	28
32	43 41	42 40	41 39	40 47	39 46	38 55	38 04	37 12	36 31	35 40	34 59	34 18	32
36	55 18	54 00	52 42	51 38	50 20	49 15	48 10	47 06	46 14	45 09	44 17	43 25	36
40	68 16	66 40	65 04	63 44	62 08	60 48	59 28	58 08	57 04	55 44	54 40	53 36	40
44	82 36	80 40	78 43	77 07	75 11	73 34	71 57	70 21	69 03	67 26	66 09	64 51	44
48	...	96 00	93 42	91 46	89 28	87 33	85 38	83 42	82 10	80 15	78 43	77 11	48
52	...	...	...	107 42	105 00	102 45	100 30	98 14	96 26	94 11	92 23	90 35	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.56	2.50	2.44	2.39	2.33	2.28	2.23	2.18	2.14	2.09	2.05	2.01	$\triangle_1$h
Log.	0.408 24	0.397 94	0.387 39	0.378 40	0.367 36	0.357 93	0.348 30	0.338 46	0.330 41	0.320 15	0.311 75	0.303 20	Log.
Limit	40	41	42	43	43	44	45	46	47	48	49	50	Minutes
Meridian	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	Altitudes

Latitude 29° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 30	0 30	0 30	0 29	0 28	0 28	0 27	0 27	0 26	0 26	0 25	4
8	2 05	2 02	2 00	1 58	1 56	1 54	1 52	1 49	1 47	1 44	1 42	1 41	8
12	4 43	4 35	4 31	4 26	4 20	4 16	4 11	4 05	4 00	3 54	3 50	3 46	12
16	8 21	8 09	8 01	7 54	7 44	7 33	7 25	7 15	7 08	6 58	6 50	6 42	16
20	13 04	12 44	12 32	12 20	12 04	11 48	11 36	11 20	11 08	10 52	10 40	10 28	20
24	18 49	18 20	18 03	17 46	17 23	16 59	16 42	16 19	16 02	15 39	15 22	15 04	24
28	25 37	24 58	24 34	24 10	23 39	23 08	22 44	22 13	21 49	21 18	20 54	20 31	28
32	33 27	32 36	32 05	31 34	30 53	30 13	29 42	29 01	28 30	27 49	27 18	26 48	32
36	42 20	41 15	40 37	39 58	39 06	38 14	37 35	36 43	36 05	35 13	34 34	33 55	36
40	52 16	50 56	50 08	49 20	48 16	47 12	46 24	45 20	44 32	43 28	42 40	41 52	40
44	63 14	61 37	60 40	59 42	58 24	57 07	56 08	54 51	53 54	52 36	51 38	50 40	44
48	75 16	73 21	72 11	71 02	69 30	67 56	66 47	65 15	64 07	62 35	61 26	60 17	48
52	88 20	86 05	84 43	83 22	81 34	79 46	78 25	76 37	75 15	73 27	72 06	70 45	52
56	102 26	99 49	98 15	96 42	94 36	92 31	90 56	88 51	87 18	85 12	83 38	82 04	56
60	117 36	114 36	112 48	111 00	108 36	106 12	104 24	102 00	100 12	97 48	96 00	94 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.96	1.91	1.88	1.85	1.81	1.77	1.74	1.70	1.67	1.63	1.60	1.57	$\triangle_1 h$
Log.	0.292 26	0.281 03	0.274 16	0.267 17	0.257 68	0.247 97	0.240 55	0.230 45	0.222 72	0.212 19	0.204 12	0.195 90	Log.
Limit	50	51	52	53	54	55	56	57	58	59	59	60	Minutes
Meridian	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 24	0 23	0 22	0 22	0 22	0 22	0 21	0 20	0 20	0 19	0 19	4
8	1 38	1 36	1 34	1 33	1 30	1 28	1 26	1 24	1 23	1 21	1 19	1 17	8
12	3 40	3 36	3 32	3 28	3 23	3 19	3 14	3 10	3 06	3 02	2 57	2 54	12
16	6 32	6 24	6 16	6 08	6 01	5 53	5 46	5 38	5 30	5 22	5 15	5 10	16
20	10 12	10 00	9 48	9 36	9 24	9 12	9 00	8 48	8 36	8 24	8 12	8 04	20
24	14 41	14 24	14 06	13 49	13 32	13 15	12 58	12 41	12 23	12 06	11 48	11 37	24
28	20 00	19 36	19 13	18 49	18 26	18 02	17 38	17 15	16 52	16 28	16 05	15 49	28
32	26 07	25 36	25 06	24 35	24 04	23 33	23 02	22 31	22 01	21 30	21 00	20 39	32
36	33 03	32 24	31 45	31 06	30 27	29 49	29 10	28 31	27 52	27 13	26 34	26 08	36
40	40 48	40 00	39 12	38 24	37 36	36 48	36 00	35 12	34 24	33 36	32 48	32 16	40
44	49 22	48 24	47 26	46 27	45 29	44 32	43 34	42 36	41 37	40 39	39 41	39 02	44
48	58 45	57 36	56 27	55 18	54 09	52 59	51 50	50 41	49 32	48 23	47 14	46 28	48
52	68 57	67 36	66 15	64 54	63 33	62 11	60 50	59 29	58 08	56 47	55 26	54 32	52
56	79 58	78 24	76 50	75 15	73 41	72 08	70 34	69 00	67 25	65 51	64 17	63 14	56
60	91 48	90 00	88 12	86 24	84 36	82 48	81 00	79 12	77 24	75 36	73 48	72 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.53	1.50	1.47	1.44	1.41	1.38	1.35	1.32	1.29	1.26	1.23	1.21	$\triangle_1 h$
Log.	0.184 69	0.176 09	0.167 32	0.158 36	0.149 22	0.139 88	0.130 33	0.120 57	0.110 59	0.100 37	0.089 91	0.082 79	Log.
Limit	60	61	62	63	64	65	66	67	68	69	70	71	Minutes
Meridian	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 18	0 18	0 17	0 17	0 16	0 15	0 15	...	...	...	4
8	1 15	1 13	1 12	1 10	1 08	1 07	1 05	1 03	1 01	...	...	...	8
12	2 50	2 45	2 42	2 38	2 34	2 30	2 27	2 23	2 19	...	...	...	12
16	5 02	4 55	4 50	4 42	4 34	4 26	4 21	4 13	4 05	...	...	...	16
20	7 52	7 40	7 32	7 20	7 08	6 56	6 48	6 36	6 24	...	...	...	20
24	11 20	11 03	10 51	10 34	10 16	9 59	9 48	9 30	9 13	...	...	...	24
28	15 25	15 01	14 46	14 22	13 59	13 35	13 20	12 57	12 33	...	...	...	28
32	20 08	19 37	19 17	18 46	18 16	17 45	17 24	16 54	16 23	...	...	...	32
36	25 30	24 51	24 25	23 46	23 07	22 28	22 02	21 23	20 44	...	...	...	36
40	31 28	30 40	30 08	29 20	28 32	27 44	27 12	26 24	25 36	...	...	...	40
44	38 05	37 07	36 28	35 30	34 32	33 33	32 55	31 56	30 58	...	...	...	44
48	45 18	44 09	43 23	42 14	41 05	39 56	39 10	38 01	36 52	...	...	...	48
52	53 10	51 49	50 55	49 34	48 13	46 52	45 58	44 37	43 16	...	...	...	52
56	61 41	60 07	59 04	57 30	55 56	54 21	53 19	51 44	50 10	...	...	...	56
60	70 48	69 00	67 48	66 00	64 12	62 24	61 12	59 24	57 36	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.18	1.15	1.13	1.10	1.07	1.04	1.02	0.99	0.96	...	...	...	$\triangle_1 h$
Log.	0.071 88	0.060 70	0.053 08	0.041 39	0.029 38	0.017 03	0.008 60	9.995 64	9.982 27	... ...	... ...	... ...	Log.
Limit	72	73	74	75	76	77	79	80	81				Minutes
Meridian	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	0 11	0 11	0 11	0 10	0 10	0 09	4
8	...	...	...	...	...	...	0 45	0 42	0 40	0 39	0 38	0 37	8
12	...	...	...	...	...	...	1 41	1 36	1 32	1 27	1 25	1 22	12
16	...	...	...	...	...	...	2 59	2 52	2 44	2 37	2 31	2 26	16
20	...	...	...	...	...	...	4 40	4 28	4 16	4 04	3 56	3 48	20
24	...	...	...	...	...	...	6 43	6 26	6 09	5 52	5 40	5 28	24
28	...	...	...	...	...	...	9 09	8 45	8 21	7 58	7 43	7 27	28
32	...	...	...	...	...	...	11 57	11 26	10 55	10 24	10 04	9 44	32
36	...	...	...	...	...	...	15 07	14 29	13 50	13 11	12 45	12 18	36
40	...	...	...	...	...	...	18 40	17 52	17 04	16 16	15 44	15 12	40
44	...	...	...	...	...	...	22 35	21 38	20 39	19 41	19 02	18 24	44
48	...	...	...	...	...	...	26 51	25 43	24 34	23 25	22 39	21 54	48
52	...	...	...	...	...	...	31 33	30 11	28 50	27 29	26 35	25 41	52
56	...	...	...	...	...	...	36 35	35 02	33 27	31 53	30 50	29 48	56
60	...	...	...	...	...	...	42 00	40 12	38 24	36 36	35 24	34 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	0.70	0.67	0.64	0.61	0.59	0.57	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	9.845 10	9.826 07	9.806 18	9.785 33	9.770 85	9.755 87	Log.
Limit							88	88	89	90	91	92	Minutes
Meridian	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	Altitudes

Latitude 30° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 54	0 56	0 58	1 00	1 02	1 04	1 07	1 09	1 12	1 15	1 18	1 22	4
8	3 38	3 45	3 51	4 00	4 08	4 17	4 26	4 36	4 48	5 00	5 13	5 28	8
12	8 10	8 25	8 41	8 59	9 17	9 37	9 59	10 22	10 48	11 15	11 46	12 18	12
16	14 30	14 59	15 27	15 57	16 31	17 07	17 45	18 26	19 12	20 01	20 54	21 54	16
20	22 40	23 24	24 08	24 56	25 48	26 44	27 44	28 48	30 00	31 16	32 40	34 12	20
24	32 38	33 42	34 46	35 54	37 09	38 30	39 57	41 29	43 12	45 02	47 02	49 15	24
28	44 26	45 52	47 18	48 52	50 34	52 24	54 21	56 27	58 48	61 17	64 02	67 02	28
32	58 02	59 54	61 46	63 50	66 03	68 26	70 59	73 43	76 48	80 02	83 38	...	32
36	73 26	75 49	78 12	...	...	...	...	...	...	...	...	...	36
40	90 40	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	3.40	3.51	3.62	3.74	3.87	4.01	4.16	4.32	4.50	4.69	4.90	5.13	Δ_1h
Log.	0.531 48	0.545 31	0.558 71	0.572 87	0.587 71	0.603 14	0.619 09	0.635 48	0.653 21	0.671 17	0.690 20	0.710 12	Log.
Limit	33	32	31	31	30	29	29	28	27	26	25	25	Minutes
Meridian	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 26	1 31	1 35	1 42	1 49	1 55	2 04	2 14	2 27	2 43	3 02	3 26	4
8	5 44	6 03	6 23	6 46	7 13	7 43	8 18	9 00	9 49	10 49	12 05	13 42	8
12	12 55	13 36	14 23	15 14	16 14	17 21	18 41	20 14	22 05	24 21	27 11	30 49	12
16	22 57	24 12	25 33	27 06	28 50	30 51	33 11	35 58	39 15	43 19	...	...	16
20	35 52	37 48	39 56	42 20	45 04	48 12	50 52	56 12	...	...	...	...	20
24	51 39	54 26	57 30	60 58	64 54	...	...	...	...	...	...	...	24
28	70 18	74 05	78 17	82 59	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	5.38	5.67	5.99	6.35	6.76	7.23	7.78	8.43	9.20	10.15	11.33	12.84	Δ_1h
Log.	0.730 78	0.753 58	0.777 43	0.802 77	0.829 95	0.859 14	0.890 98	0.925 83	0.963 79	1.006 47	1.054 23	1.108 57	Log.
Limit	24	23	22	21	20	19	18	17	15	14	13	12	Minutes
Meridian	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 58	4 43	...	...	...	...	...	...	...	...	...	4 15	4
8	15 51	18 51	...	...	...	...	...	...	...	...	...	17 02	8
12	35 40	...	...	...	...	...	...	...	...	...	...	38 22	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	14.86	17.68	...	...	...	...	...	...	...	...	...	15.98	$\triangle_1 h$
Log.	1.172 02	1.247 48	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.203 58	Log.
Limit	10	8	7	6	4	2	0	2	4	6	8	9	Minutes
Meridian	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 31	2 59	2 34	2 15	2 00	1 47	1 37	1 28	1 21	1 15	1 08	1 03	4
8	14 02	11 53	10 16	9 01	8 00	7 11	6 29	5 54	5 24	4 57	4 35	4 14	8
12	31 35	26 44	23 06	20 17	18 00	16 09	14 36	13 16	12 09	11 09	10 18	9 32	12
16	...	...	41 06	36 03	32 00	28 43	25 56	23 36	21 35	19 51	18 18	16 56	16
20	...	...	...	56 20	50 00	44 52	40 32	36 52	33 44	31 00	28 36	26 28	20
24	...	...	...	...	...	64 36	58 22	53 05	48 35	44 39	41 11	38 06	24
28	...	...	...	...	...	...	...	72 16	66 07	60 45	56 04	51 53	28
32	...	...	...	...	...	...	...	...	...	...	73 13	67 46	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	13.16	11.14	9.63	8.45	7.50	6.73	6.08	5.53	5.06	4.65	4.29	3.97	$\triangle_1 h$
Log.	1.119 26	1.046 89	0.983 63	0.926 86	0.875 06	0.828 02	0.783 90	0.742 73	0.704 15	0.667 45	0.632 46	0.598 79	Log.
Limit	10	12	14	16	17	19	21	23	24	25	26	27	Minutes
Meridian	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	Altitudes

Latitude 30° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 59	0 54	0 51	0 47	0 44	0 42	0 39	0 37	0 35	0 33	0 30	0 29	4
8	3 55	3 40	3 25	3 11	2 59	2 47	2 38	2 28	2 19	2 11	2 02	1 56	8
12	8 50	8 14	7 41	7 11	6 42	6 17	5 55	5 32	5 12	4 54	4 37	4 20	12
16	15 42	14 38	13 39	12 45	11 54	11 11	10 29	9 52	9 16	8 42	8 11	7 44	16
20	24 32	22 52	21 20	19 56	18 36	17 28	16 24	15 24	14 28	13 36	12 48	12 04	20
24	35 20	32 55	30 43	28 42	26 47	25 10	23 37	22 11	20 50	19 35	18 26	17 23	24
28	48 05	44 50	41 49	39 05	36 28	34 14	32 09	30 11	28 21	36 39	25 06	23 39	28
32	62 48	58 33	54 37	51 02	47 37	44 42	41 59	39 25	37 02	34 49	32 46	30 53	32
36	79 30	74 05	69 07	64 35	60 16	56 36	53 08	49 54	46 53	44 04	41 28	39 06	36
40	...	...	85 20	79 44	74 24	69 52	65 36	61 36	57 52	54 24	51 12	48 16	40
44	...	...	...	...	...	...	79 22	74 32	70 02	65 49	61 57	58 24	44
48	...	...	...	...	...	...	...	...	83 19	78 20	73 44	69 30	48
52	...	...	...	...	...	...	...	...	...	...	86 32	81 34	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.68	3.43	3.20	2.99	2.79	2.62	2.46	2.31	2.17	2.04	1.92	1.81	$\triangle_1$h
Log	0.565 85	0.535 29	0.505 15	0.475 67	0.445 60	0.418 30	0.390 94	0.363 61	0.336 46	0.309 63	0.283 30	0.257 68	Log.
Limit	29	30	32	32	33	34	36	38	39	41	43	45	Minutes
Meridian	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 26	0 24	0 22	0 21	0 20	0 19	0 18	0 16	0 15	0 14	0 13	4
8	1 49	1 42	1 36	1 31	1 25	1 20	1 15	1 11	1 06	1 02	0 57	0 53	8
12	4 05	3 50	3 37	3 25	3 11	3 00	2 50	2 39	2 28	2 20	2 10	1 59	12
16	7 15	6 50	6 27	6 03	5 41	5 20	5 02	4 45	4 24	4 08	3 50	3 33	16
20	11 20	10 40	10 04	9 28	8 52	8 20	7 52	7 24	6 52	6 28	6 00	5 32	20
24	16 19	15 22	14 30	13 38	12 46	12 00	11 20	10 40	9 53	9 18	8 38	7 58	24
28	22 13	20 54	19 44	18 34	17 23	16 20	15 25	14 30	13 28	12 41	11 46	10 51	28
32	29 01	27 18	25 46	24 14	22 42	21 20	20 08	18 56	17 35	16 34	15 22	14 10	32
36	36 43	34 34	32 37	30 40	28 44	27 00	25 30	23 59	22 15	20 57	19 26	17 56	36
40	45 20	42 40	40 16	37 52	35 28	33 20	31 28	29 36	27 28	25 52	24 00	22 08	40
44	54 51	51 38	48 43	45 49	42 55	40 20	38 05	35 49	33 14	31 18	29 02	26 47	44
48	65 15	61 26	57 59	54 32	51 04	48 00	45 18	42 37	39 33	37 15	34 34	31 52	48
52	76 37	72 06	68 03	64 00	59 56	56 20	53 10	50 01	46 25	43 43	40 34	37 24	52
56	88 51	83 38	78 55	74 13	69 31	65 20	61 41	58 01	53 50	50 42	47 02	43 23	56
60	...	...	90 36	85 12	79 48	75 00	70 48	66 36	61 48	58 12	54 00	49 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.70	1.60	1.51	1.42	1.33	1.25	1.18	1.11	1.03	0.97	0.90	0.83	$\triangle_1$h
Log.	0.230 45	0.204 12	0.178 98	0.152 29	0.123 85	0.096 91	0.071 88	0.045 32	0.012 84	9.986 77	9.954 24	9.919 08	Log.
Limit	47	48	50	52	54	56	57	59	61	63	65	67	Minutes
Meridian	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	Altitudes

Latitude 30° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 54	0 53	0 51	0 50	0 48	0 47	0 46	0 45	0 44	0 43	0 42	0 41	4
8	3 38	3 31	3 26	3 19	3 14	3 09	3 04	2 59	2 56	2 51	2 47	2 43	8
12	8 10	7 55	7 42	7 29	7 16	7 05	6 55	6 43	6 35	6 24	6 15	6 06	12
16	14 30	14 05	13 42	13 19	12 56	12 35	12 17	11 57	11 41	11 24	11 09	10 50	16
20	22 40	22 00	21 24	20 48	20 12	19 40	19 12	18 40	18 16	17 48	17 24	16 56	20
24	32 38	31 41	30 49	29 58	29 05	28 19	27 39	26 53	26 18	25 38	25 04	24 23	24
28	44 26	43 07	41 57	40 46	39 36	38 33	37 38	36 35	35 48	34 53	34 06	33 11	28
32	58 02	56 19	54 47	53 14	51 43	50 21	49 09	47 47	46 46	45 34	44 32	43 21	32
36	73 26	71 17	69 20	67 24	65 27	63 43	62 13	60 29	59 11	57 41	56 23	54 52	36
40	90 40	88 00	85 36	83 12	80 48	78 40	76 48	74 40	73 04	71 12	69 36	67 44	40
44	...	...	...	...	...	...	...	...	88 24	86 10	84 13	81 57	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.40	3.30	3.21	3.12	3.03	2.95	2.88	2.80	2.74	2.67	2.61	2.54	$\triangle_1 h$
Log.	0.531 48	0.518 51	0.506 51	0.494 15	0.481 44	0.469 82	0.459 39	0.447 16	0.437 75	0.426 51	0.416 64	0.404 83	Log.
Limit	33	33	34	35	36	37	37	38	38	39	40	40	Minutes
Meridian	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 39	0 38	0 38	0 37	0 36	0 35	0 35	0 34	0 33	0 33	0 32	0 31	4
8	2 40	2 36	2 32	2 28	2 26	2 22	2 19	2 16	2 14	2 11	2 08	2 05	8
12	5 59	5 50	5 43	5 34	5 27	5 20	5 14	5 06	5 01	4 54	4 48	4 43	12
16	10 37	10 22	10 09	9 54	9 41	9 28	9 18	9 06	8 55	8 42	8 32	8 21	16
20	16 36	16 12	15 52	15 28	15 08	14 48	14 32	14 12	13 56	13 36	13 20	13 04	20
24	23 54	23 19	22 51	22 17	21 47	21 19	20 56	20 27	20 04	19 35	19 12	18 49	24
28	32 33	31 46	31 06	30 19	29 40	29 01	28 29	27 50	27 19	26 39	26 08	25 37	28
32	42 30	41 29	40 37	39 35	38 45	37 53	37 12	36 21	35 40	34 49	34 08	33 27	32
36	53 47	52 29	51 25	50 07	49 02	47 57	47 06	46 01	45 09	44 04	43 12	42 20	36
40	66 24	64 48	63 28	61 52	60 32	59 12	58 08	56 48	55 44	54 24	53 20	52 16	40
44	80 20	78 24	76 48	74 52	73 15	71 38	70 21	68 44	67 26	65 49	64 32	63 14	44
48	95 37	93 19	91 23	89 05	87 10	85 15	83 42	81 46	80 15	78 20	76 48	75 16	48
52	...	...	107 15	104 33	102 18	100 03	98 14	95 59	94 11	91 56	90 08	88 20	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.49	2.43	2.38	2.32	2.27	2.22	2.18	2.13	2.09	2.04	2.00	1.96	$\triangle_1 h$
Log.	0.396 20	0.385 61	0.376 58	0.365 49	0.356 03	0.346 35	0.338 46	0.328 38	0.320 15	0.309 63	0.301 03	0.292 26	Log.
Limit	41	42	43	44	44	45	46	47	48	49	50	51	Minutes
Meridian	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	Altitudes

Latitude 30° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 30	0 30	0 29	0 29	0 28	0 27	0 27	0 26	0 26	0 25	0 25	4
8	2 02	2 00	1 58	1 56	1 54	1 52	1 49	1 46	1 44	1 42	1 41	1 39	8
12	4 37	4 29	4 25	4 20	4 15	4 11	4 05	3 59	3 54	3 50	3 46	3 42	12
16	8 11	7 59	7 51	7 44	7 33	7 25	7 15	7 05	6 58	6 50	6 42	6 34	16
20	12 48	12 28	12 16	12 04	11 48	11 36	11 20	11 04	10 52	10 40	10 28	10 16	20
24	18 26	17 57	17 40	17 23	16 59	16 42	16 19	15 57	15 39	15 22	15 04	14 47	24
28	25 06	24 26	24 02	23 39	23 08	22 44	22 13	21 41	21 18	20 54	20 31	20 07	28
32	32 46	31 55	31 24	30 53	30 13	29 42	29 01	28 19	27 49	27 18	26 48	26 17	32
36	41 28	40 24	39 45	39 06	38 14	37 35	36 43	35 52	35 13	34 34	33 55	33 16	36
40	51 12	49 52	49 04	48 16	47 12	46 24	45 20	44 16	43 28	42 40	41 52	41 04	40
44	61 57	60 21	59 22	58 24	57 07	56 08	54 51	53 34	52 36	51 38	50 40	49 41	44
48	73 44	71 48	70 39	69 30	67 56	66 47	65 15	63 44	62 35	61 26	60 17	59 08	48
52	86 32	84 16	82 55	81 34	79 46	78 25	76 37	74 48	73 27	72 06	70 45	69 24	52
56	100 21	97 45	96 10	94 36	92 31	90 56	88 51	86 46	85 12	83 38	82 04	80 29	56
60	115 12	112 12	110 24	108 36	106 12	104 24	102 00	99 36	97 48	96 00	94 12	92 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.92	1.87	1.84	1.81	1.77	1.74	1.70	1.66	1.63	1.60	1.57	1.54	Δ_1h
Log.	0.283 30	0.271 84	0.264 82	0.257 68	0.247 97	0.240 55	0.230 45	0.220 11	0.212 19	0.204 12	0.195 90	0.187 52	Log.
Limit	51	52	53	53	54	55	56	57	58	59	60	60	Minutes
Meridian	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 24	0 23	0 23	0 22	0 22	0 22	0 21	0 21	0 20	0 20	0 19	0 19	4
8	1 36	1 35	1 33	1 31	1 29	1 27	1 25	1 23	1 21	1 20	1 18	1 16	8
12	3 37	3 34	3 29	3 25	3 20	3 16	3 11	3 07	3 03	2 59	2 56	2 51	12
16	6 27	6 18	6 11	6 03	5 56	5 48	5 41	5 33	5 25	5 17	5 12	5 05	16
20	10 04	9 52	9 40	9 28	9 16	9 04	8 52	8 40	8 28	8 16	8 08	7 56	20
24	14 30	14 12	13 55	13 38	13 21	13 04	12 46	12 29	12 11	11 54	11 43	11 26	24
28	19 44	19 21	18 57	18 34	18 10	17 46	17 23	16 59	16 36	16 12	15 57	15 33	28
32	25 46	25 16	24 45	24 14	23 43	23 12	22 42	22 11	21 41	21 10	20 49	20 18	32
36	32 37	31 58	31 19	30 40	30 02	29 23	28 44	28 05	27 26	26 47	26 41	25 43	36
40	40 16	39 28	38 40	37 52	37 04	36 16	35 28	34 40	33 52	33 04	32 32	31 44	40
44	48 43	47 45	46 47	45 49	44 51	44 53	42 55	41 57	40 59	40 00	39 22	38 24	44
48	57 59	56 50	55 41	54 32	53 22	52 13	51 04	49 55	48 46	47 37	46 51	45 41	48
52	68 03	66 42	65 21	64 00	62 38	61 17	59 56	58 35	57 14	55 53	54 59	53 37	52
56	78 55	77 21	75 47	74 13	72 39	71 05	69 31	67 57	66 23	64 48	63 46	62 12	56
60	90 36	88 48	87 00	85 12	83 24	81 36	79 48	78 00	76 12	74 24	73 12	71 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.51	1.48	1.45	1.42	1.39	1.36	1.33	1.30	1.27	1.24	1.22	1.19	Δ_1h
Log.	0.178 98	0.170 26	0.161 37	0.152 29	0.143 01	0.133 54	0.123 85	0.113 94	0.103 80	0.093 42	0.086 36	0.075 55	Log.
Limit	61	62	63	64	65	66	67	68	69	70	71	72	Minutes
Meridian	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 18	0 17	0 17	0 16	0 16	0 15	0 15	...	...	...	4
8	1 14	1 13	1 11	1 09	1 08	1 06	1 04	1 02	1 01	...	...	...	8
12	2 47	2 44	2 59	2 36	2 33	2 28	2 24	2 20	2 17	...	...	...	12
16	4 57	4 52	4 45	4 36	4 31	4 24	4 16	4 08	4 03	...	...	...	16
20	7 44	7 36	7 24	7 12	7 04	6 52	6 40	6 28	6 20	...	...	...	20
24	11 09	10 57	10 40	10 22	10 11	9 53	9 36	9 18	9 07	...	...	...	24
28	15 09	14 53	14 30	14 07	13 51	13 28	13 04	12 41	12 25	...	...	...	28
32	19 47	19 27	18 56	18 26	18 05	17 35	17 04	16 34	16 13	...	...	...	32
36	25 04	24 38	23 59	23 20	22 54	22 15	21 36	20 57	20 31	...	...	...	36
40	30 56	30 24	29 36	28 48	28 16	27 28	26 40	25 52	25 20	...	...	...	40
44	37 26	36 47	35 49	34 51	34 12	33 14	32 16	31 18	30 39	...	...	...	44
48	44 32	43 46	42 37	41 28	40 42	39 33	38 24	37 15	36 29	...	...	...	48
52	52 16	51 22	50 01	48 40	47 46	46 25	45 04	43 43	42 49	...	...	...	52
56	60 38	59 35	58 01	56 27	55 24	53 50	52 16	50 42	49 39	...	...	...	56
60	69 36	68 24	66 36	64 48	63 36	61 48	60 00	58 12	57 00	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.16	1.14	1.11	1.08	1.06	1.03	1.00	0.97	0.95	...	...	...	$\triangle_1 h$
Log.	0.064 46	0.056 90	0.045 32	0.033 42	0.025 31	0.012 84	0.00 ...	9.986 77	9.977 72	... ...	... ...	... ...	Log.
Limit	73	73	74	75	76	77	79	80	81				Minutes
Meridian	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	0 12	0 11	0 11	0 11	0 11	0 10	0 09	0 09	4
8	...	...	...	...	0 48	0 46	0 44	0 42	0 40	0 39	0 38	0 37	8
12	...	...	...	...	1 48	1 44	1 39	1 36	1 32	1 27	1 25	1 22	12
16	...	...	...	...	3 12	3 04	2 57	2 52	2 44	2 37	2 31	2 26	16
20	...	...	...	...	5 00	4 48	4 36	4 28	4 16	4 04	3 56	3 48	20
24	...	...	...	...	7 12	6 55	6 38	6 26	6 09	5 52	5 40	5 28	24
28	...	...	...	...	9 48	9 25	9 01	8 45	8 21	7 58	7 43	7 27	28
32	...	...	...	...	12 48	12 17	11 46	11 26	10 55	10 24	10 04	9 44	32
36	...	...	...	...	16 12	15 33	14 55	14 29	13 50	13 11	12 45	12 18	36
40	...	...	...	...	20 00	19 12	18 24	17 52	17 04	16 16	15 44	15 12	40
44	...	...	...	...	24 12	23 14	22 16	21 38	20 39	19 41	19 02	18 24	44
48	...	...	...	...	28 46	27 37	26 29	25 43	24 34	23 25	22 39	21 54	48
52	...	...	...	...	33 48	32 27	31 05	30 11	28 50	27 29	26 35	25 41	52
56	...	...	...	...	39 12	37 38	36 04	35 02	33 27	31 53	30 50	29 48	56
60	...	...	...	...	45 00	43 12	41 24	40 12	38 24	36 36	35 24	34 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	0.75	0.72	0.69	0.67	0.64	0.61	0.59	0.57	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	9.875 06	9.857 33	9.838 85	9.826 07	9.806 18	9.785 33	9.770 85	9.755 87	Log.
Limit					86	87	87	88	88	89	90	91	Minutes
Meridian	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Altitudes

Latitude 31° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 52	0 54	0 55	0 57	0 59	1 01	1 03	1 06	1 08	1 11	1 14	1 17	4
8	3 30	3 36	3 43	3 49	3 57	4 05	4 13	4 23	4 34	4 45	4 56	5 09	8
12	7 51	8 05	8 20	8 36	8 53	9 10	9 31	9 51	10 15	10 40	11 06	11 35	12
16	13 57	14 23	14 48	15 16	15 47	16 18	16 53	17 33	18 13	18 56	19 46	20 37	16
20	21 48	22 28	23 08	23 52	24 40	25 28	26 24	27 24	28 28	29 36	30 52	32 12	20
24	31 23	32 21	33 18	34 22	35 31	36 41	38 01	39 28	40 59	42 37	44 27	46 22	24
28	42 44	44 02	45 21	46 47	48 21	49 55	51 45	53 42	55 48	58 01	60 30	63 07	28
32	55 49	57 31	59 14	61 06	63 09	65 11	67 35	70 08	72 53	75 47	79 01	82 26	32
36	70 38	72 48	74 57	77 20	79 55	...	...	...	...	...	...	...	36
40	87 12	89 52	92 32	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.27	3.37	3.47	3.58	3.70	3.82	3.96	4.11	4.27	4.44	4.63	4.83	$\triangle_1 h$
Log.	0.514 55	0.527 63	0.540 33	0.553 88	0.568 20	0.582 06	0.597 70	0.613 84	0.630 43	0.647 38	0.665 58	0.683 95	Log.
Limit	34	33	32	32	31	30	30	29	28	27	26	26	Minutes
Meridian	59°	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 21	1 25	1 29	1 34	1 40	1 47	1 54	2 03	2 12	2 25	2 39	2 59	4
8	5 24	5 40	5 56	6 17	6 40	7 05	7 35	8 09	8 51	9 39	10 38	11 52	8
12	12 09	12 44	13 21	14 10	15 00	15 57	17 05	18 21	19 54	21 43	23 58	26 42	12
16	21 35	22 40	23 43	25 10	26 40	28 23	30 23	32 39	35 22	38 37	42 34	...	16
20	33 44	35 24	37 04	39 20	41 40	44 20	47 28	51 00	55 16	...	...	...	20
24	48 35	50 59	53 23	56 38	60 00	63 51	...	...	...	...	...	...	24
28	66 07	69 23	72 39	77 06	81 40	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.06	5.31	5.56	5.90	6.25	6.65	7.12	7.65	8.29	9.05	9.98	11.13	$\triangle_1 h$
Log.	0.704 15	0.725 09	0.945 07	0.770 85	0.795 88	0.822 82	0.852 48	0.883 66	0.918 55	0.956 65	0.999 13	1.046 50	Log.
Limit	25	24	23	22	21	20	19	18	17	16	15	14	Minutes
Meridian	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	Altitudes

Latitude 31° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 22	3 54	4 38	...	...	...	...	...	...	...	...	...	4
8	13 27	15 34	18 31	...	...	...	...	...	...	...	...	...	8
12	30 17	35 01	41 40	...	...	...	...	...	...	...	...	...	12
16	53 51	62 15	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	12.62	14.59	17.36	...	...	...	...	...	...	...	...	...	Δ_1h
Log.	1.101 06	1.164 06	1.239 55	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	13	12	10	8	6	4	2	0	2	4	6	7	Minutes
Meridian	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	4 10	3 26	2 54	2 30	2 12	1 57	1 45	1 34	1 26	1 18	1 12	1 07	4
8	16 40	13 43	11 36	11 02	8 48	7 48	7 00	6 18	5 44	5 14	4 49	4 26	8
12	37 39	30 52	26 06	22 34	19 47	17 32	15 45	14 13	12 55	11 49	10 51	9 59	12
16	...	...	46 25	40 06	35 09	31 12	27 59	25 15	22 57	20 59	19 17	17 45	16
20	...	...	...	...	54 56	48 44	43 44	39 28	35 52	32 48	30 08	27 44	20
24	...	...	...	...	...	...	62 59	56 50	51 39	47 14	43 24	39 57	24
28	...	...	...	...	...	...	...	...	70 18	64 18	59 04	54 21	28
28	...	...	...	...	...	...	...	...	...	...	...	70 59	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	15.62	12.86	10.88	9.40	8.24	7.31	6.56	5.92	5.38	4.92	4.52	4.16	Δ_1h
Log.	1.193 68	1.109 24	1.036 63	0.973 13	0.915 93	0.863 92	0.816 90	0.772 32	0.730 78	0.691 97	0.655 14	0.619 09	Log.
Limit	9	11	13	15	16	17	19	21	23	24	25	26	Minutes
Meridian	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	Altitudes

Latitude 31° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 02	0 57	0 53	0 50	0 46	0 43	0 40	0 38	0 35	0 33	0 31	0 30	4
8	4 06	3 49	3 32	3 18	3 05	2 53	2 42	2 32	2 23	2 14	2 05	1 58	8
12	9 14	8 34	7 58	7 26	6 56	6 29	6 04	5 41	5 21	5 01	4 43	4 26	12
16	16 26	15 14	14 10	13 14	12 20	11 30	10 48	10 07	9 31	8 55	8 21	7 54	16
20	25 40	23 48	22 08	20 40	19 16	18 00	16 52	15 48	14 52	13 56	13 04	12 20	20
24	36 58	34 16	31 53	29 46	27 45	25 55	24 17	22 45	21 24	20 04	18 49	17 46	24
28	50 18	46 39	43 23	40 30	37 46	35 17	33 04	30 58	29 09	27 19	25 37	24 10	28
32	65 42	60 56	56 39	52 54	49 19	46 05	43 11	40 27	38 04	35 40	33 27	31 34	32
36	...	77 07	71 43	66 58	62 26	58 19	54 39	51 12	48 10	45 09	42 20	39 58	36
40	...	...	...	...	...	72 00	67 28	63 12	59 28	55 44	52 16	49 20	40
44	...	...	...	...	...	...	...	76 39	71 57	67 26	63 14	59 42	44
48	...	...	...	...	...	...	...	...	...	80 15	75 16	71 02	48
52	...	...	...	...	...	...	...	...	...	...	...	83 22	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	3.85	3.57	3.32	3.10	2.89	2.70	2.53	2.37	2.23	2.09	1.96	1.85	$\Delta_1 h$
Log.	0.585 46	0.552 67	0.521 14	0.491 36	0.460 90	0.431 36	0.403 12	0.374 75	0.348 30	0.320 15	0.292 26	0.267 17	Log.
Limit	28	30	31	31	32	33	35	37	38	40	42	44	Minutes
Meridian	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 26	0 24	0 22	0 22	0 20	0 19	0 18	0 17	0 15	0 14	0 13	4
8	1 52	1 44	1 38	1 33	1 26	1 21	1 16	1 11	1 07	1 02	0 58	0 54	8
12	4 11	3 54	3 40	3 28	3 14	3 03	2 51	2 41	2 31	2 22	2 11	2 01	12
16	7 25	6 58	6 32	6 08	5 46	5 25	5 05	4 47	4 29	4 10	3 53	3 35	16
20	11 36	10 52	10 12	9 36	9 00	8 28	7 56	7 28	7 00	6 32	6 04	5 36	20
24	16 42	15 39	14 41	13 49	12 58	12 11	11 26	10 46	10 05	9 24	8 44	8 04	24
28	22 44	21 18	20 00	18 49	17 38	16 36	15 33	14 38	13 43	12 49	11 54	10 58	28
32	29 42	27 49	26 07	24 35	23 02	21 41	20 18	19 06	17 55	16 44	15 32	14 20	32
36	37 35	35 13	33 03	31 06	29 10	27 26	25 43	24 12	22 41	21 10	19 39	18 09	36
40	46 24	43 28	40 48	38 24	36 00	33 52	31 44	29 52	28 00	26 08	24 16	22 24	40
44	56 08	52 36	49 22	46 27	43 34	40 59	38 24	36 09	33 53	31 37	29 21	27 06	44
48	66 47	62 35	58 45	55 18	51 50	48 46	45 41	43 00	40 19	37 38	34 57	32 15	48
52	78 25	73 27	68 57	64 54	60 50	57 14	53 37	50 28	47 19	44 10	41 01	37 51	52
56	90 56	85 12	79 58	75 15	70 34	66 23	62 12	58 33	54 53	51 13	47 33	43 54	56
60	...	...	91 48	86 24	81 00	76 12	71 24	67 12	63 00	58 48	54 36	50 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.74	1.63	1.53	1.44	1.35	1.27	1.19	1.12	1.05	0.98	0.91	0.84	$\Delta_1 h$
Log.	0.240 55	0.212 19	0.184 69	0.158 36	0.130 33	0.103 80	0.075 55	0.049 22	0.021 19	9.991 23	9.959 04	9.924 28	Log.
Limit	46	47	49	51	53	55	56	58	60	62	64	66	Minutes
Meridian	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	Altitudes

Latitude 31° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 52	0 51	0 49	0 48	0 46	0 46	0 44	0 43	0 43	0 41	0 40	0 39	4
8	3 30	3 23	3 18	3 13	3 07	3 02	2 58	2 54	2 49	2 46	2 42	2 39	8
12	7 51	7 38	7 25	7 13	7 02	6 50	6 41	6 30	6 21	6 13	6 04	5 56	12
16	13 57	13 34	13 11	12 51	12 30	12 10	11 51	11 34	11 19	11 03	10 48	10 32	16
20	21 48	21 12	20 36	20 04	19 32	19 00	18 32	18 04	17 40	17 16	16 52	16 28	20
24	31 23	30 32	29 40	28 54	28 07	27 22	26 41	26 01	25 27	24 52	24 17	23 42	24
28	42 44	41 33	40 23	39 20	38 18	37 14	36 20	35 25	34 37	33 31	33 04	32 17	28
32	55 49	54 16	52 44	51 22	50 01	48 38	47 27	46 15	45 13	44 12	43 11	42 10	32
36	70 38	68 42	66 45	65 01	63 17	61 34	60 03	58 32	57 15	55 57	54 39	53 21	36
40	87 12	84 48	82 24	80 16	78 08	76 00	74 08	72 16	70 40	69 04	67 28	65 52	40
44	...	...	...	...	...	...	...	87 26	85 31	83 34	81 38	79 42	44
48	...	...	...	...	...	...	...	...	...	...	...	94 51	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.27	3.18	3.09	3.01	2.93	2.85	2.78	2.71	2.65	2.59	2.53	2.47	$\triangle_1$h
Log.	0.514 55	0.502 43	0.489 96	0.478 57	0.466 87	0.454 84	0.444 04	0.432 97	0.423 25	0.413 30	0.403 12	0.392 70	Log.
Limit	34	34	35	36	37	38	38	39	39	40	41	41	Minutes
Meridian	59°	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 38	0 37	0 36	0 35	0 35	0 34	0 33	0 33	0 31	0 31	0 30	4
8	2 35	2 31	2 28	2 25	2 22	2 19	2 15	2 13	2 11	2 07	2 04	2 02	8
12	5 47	5 40	5 32	5 26	5 18	5 12	5 05	5 00	4 54	4 47	4 41	4 35	12
16	10 17	10 04	9 52	9 38	9 26	9 16	9 03	8 52	8 42	8 29	8 19	8 09	16
20	16 04	15 44	15 24	15 04	14 44	14 28	14 08	13 52	13 36	13 16	13 00	12 44	20
24	23 08	22 40	22 11	21 42	21 13	20 50	20 22	19 58	19 35	19 06	18 43	18 20	24
28	31 30	30 50	30 11	29 32	28 53	28 21	27 42	27 11	26 39	26 01	25 29	24 58	28
32	41 08	40 16	39 25	38 34	37 43	37 02	36 10	35 30	34 49	33 58	33 17	32 36	32
36	52 03	50 59	49 54	48 49	47 44	46 53	45 48	44 56	44 04	42 59	42 07	41 15	36
40	64 16	62 56	61 36	60 16	58 56	57 52	56 32	55 28	54 24	53 04	52 00	50 56	40
44	77 45	76 09	74 32	72 55	71 18	70 02	68 25	67 07	65 49	64 12	62 55	61 37	44
48	92 33	90 37	88 42	86 47	84 52	83 19	81 24	79 52	78 20	76 25	74 53	73 21	48
52	...	106 21	104 06	101 51	99 36	97 47	95 32	93 44	91 56	89 41	87 53	86 05	52
56	...	...	...	...	...	...	...	...	...	103 29	101 55	99 49	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.41	2.36	2.31	2.26	2.21	2.17	2.12	2.08	2.04	1.99	1.95	1.91	$\triangle_1$h
Log.	0.382 02	0.372 91	0.363 61	0.354 11	0.344 39	0.336 46	0.326 34	0.318 06	0.309 63	0.298 85	0.290 03	0.281 03	Log.
Limit	42	43	44	45	45	46	47	48	49	50	51	52	Minutes
Meridian	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	Altitudes

Latitude 31° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 29	0 29	0 28	0 27	0 27	0 27	0 26	0 26	0 25	0 25	0 24	4
8	2 00	1 57	1 55	1 54	1 51	1 49	1 46	1 44	1 42	1 41	1 39	1 36	8
12	4 31	4 23	4 19	4 16	4 09	4 05	3 59	3 54	3 50	3 46	3 42	3 37	12
16	8 01	7 49	7 41	7 33	7 23	7 15	7 05	6 58	6 50	6 42	6 34	6 27	16
20	12 32	12 12	12 00	11 48	11 32	11 20	11 04	10 52	10 40	10 28	10 16	10 04	20
24	18 03	17 34	17 17	16 59	16 36	16 19	15 57	15 39	15 22	15 04	14 47	14 30	24
28	24 34	23 55	23 31	23 08	22 37	22 13	21 41	21 18	20 54	20 31	20 07	19 44	28
32	32 05	31 13	30 43	30 13	29 32	29 01	28 19	27 49	27 18	26 48	26 17	25 46	32
36	40 37	39 32	38 53	38 14	37 22	36 43	35 52	35 13	34 34	33 55	33 16	32 37	36
40	50 08	48 48	48 00	47 12	46 08	45 20	44 16	43 28	42 40	41 52	41 04	40 16	40
44	60 40	59 03	58 05	57 07	55 49	54 51	53 34	52 36	51 38	50 40	49 41	48 43	44
48	72 11	70 16	69 07	67 56	66 24	65 15	63 44	62 35	61 26	60 17	59 08	57 59	48
52	84 43	82 28	81 07	79 46	77 58	76 37	74 48	73 27	72 06	70 45	69 24	68 03	52
56	98 15	95 39	94 05	92 31	90 25	88 51	86 46	85 12	83 38	82 04	80 29	78 55	56
60	112 48	109 48	108 00	106 12	103 48	102 00	99 36	97 48	96 00	94 12	92 24	90 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.88	1.83	1.80	1.77	1.73	1.70	1.66	1.63	1.60	1.57	1.54	1.51	$\triangle_1 h$
Log.	0.274 16	0.262 45	0.255 27	0.247 97	0.238 05	0.230 45	0.220 11	0.212 19	0.204 12	0.195 90	0.187 52	0.178 98	Log.
Limit	52	53	53	54	55	56	57	57	58	59	60	61	Minutes
Meridian	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 23	0 22	0 22	0 22	0 22	0 21	0 20	0 20	0 19	0 19	0 19	4
8	1 35	1 33	1 31	1 30	1 27	1 25	1 23	1 22	1 21	1 19	1 17	1 15	8
12	3 34	3 29	3 25	3 22	3 16	3 11	3 08	3 05	3 02	2 57	2 53	2 48	12
16	6 18	6 11	6 03	5 58	5 48	5 41	5 36	5 27	5 22	5 15	5 07	5 00	16
20	9 52	9 40	9 28	9 20	9 04	8 52	8 44	8 32	8 24	8 12	8 00	7 48	20
24	14 12	13 55	13 38	13 26	13 04	12 46	12 35	12 17	12 06	11 48	11 31	11 14	24
28	19 21	18 57	18 34	18 18	17 46	17 23	17 07	16 44	16 28	16 05	15 41	15 17	28
32	25 16	24 45	24 14	23 54	23 12	22 42	22 21	21 51	21 30	21 00	20 29	19 58	32
36	31 58	31 19	30 40	30 14	29 23	28 44	28 18	27 39	27 13	26 34	25 55	25 17	36
40	39 28	38 40	37 52	37 20	36 16	35 28	34 56	34 08	33 36	32 48	32 00	31 12	40
44	47 45	46 47	45 49	45 10	43 53	42 55	42 16	41 18	40 39	39 41	38 43	37 46	44
48	56 50	55 41	54 32	53 46	52 13	51 04	50 18	49 09	48 23	47 14	46 05	44 55	48
52	66 42	65 21	64 00	63 06	61 17	59 56	59 02	57 41	56 47	55 26	54 05	52 43	52
56	77 21	75 37	74 13	73 10	71 05	69 31	68 28	66 54	65 51	64 17	62 43	61 10	56
60	88 48	87 00	85 12	84 00	81 36	79 48	78 36	76 48	75 36	73 48	72 00	70 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.48	1.45	1.42	1.40	1.36	1.33	1.31	1.28	1.26	1.23	1.20	1.17	$\triangle_1 h$
Log.	0.170 26	0.161 37	0.152 29	0.146 13	0.133 54	0.123 85	0.117 27	0.107 21	0.100 27	0.089 91	0.079 18	0.068 19	Log.
Limit	62	63	64	65	66	67	68	69	70	71	72	73	Minutes
Meridian	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 18	0 18	0 17	0 17	0 16	0 15	...	...	...	...	...	4
8	1 13	1 11	1 10	1 08	1 07	1 05	1 03	...	...	...	...	...	8
12	2 45	2 41	2 38	2 34	2 30	2 27	2 23	...	...	...	...	...	12
16	4 55	4 47	4 42	4 34	4 26	4 21	4 13	...	...	...	...	...	16
20	7 40	7 28	7 20	7 08	6 56	6 48	6 36	...	...	...	...	...	20
24	11 03	10 46	10 34	10 16	9 59	9 48	9 30	...	...	...	...	...	24
28	15 01	14 38	14 22	13 59	13 35	13 20	12 57	...	...	...	...	...	28
32	19 37	19 06	18 46	18 16	17 45	17 24	16 54	...	...	...	...	...	32
36	24 51	24 12	23 46	23 07	22 28	22 02	21 23	...	...	...	...	...	36
40	30 40	29 52	29 20	28 32	27 44	27 12	26 24	...	...	...	...	...	40
44	37 07	36 09	35 30	34 32	33 33	32 55	31 56	...	...	...	...	...	44
48	44 09	43 00	42 14	41 05	39 56	39 10	38 01	...	...	...	...	...	48
52	51 49	50 28	49 34	48 13	46 52	45 58	44 37	...	...	...	...	...	52
56	60 07	58 33	57 30	55 56	54 21	53 19	51 44	...	...	...	...	...	56
60	69 00	67 12	66 00	64 12	62 24	61 12	59 24	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.15	1.12	1.10	1.07	1.04	1.02	0.99	...	...	...	...	...	$\Delta_1 h$
Log.	0.060 70	0.049 22	0.041 39	0.029 38	0.017 03	0.008 60	9.995 64	... ...	... ...	... ...	... ...	... ...	Log.
Limit	74	74	75	76	77	78	79						Minutes
Meridian	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	0 12	0 11	0 11	0 11	0 10	0 10	0 09	0 09	4
8	...	...	...	...	0 47	0 46	0 44	0 42	0 40	0 39	0 38	0 37	8
12	...	...	...	...	1 47	1 44	1 39	1 35	1 30	1 27	1 25	1 22	12
16	...	...	...	...	3 09	3 04	2 57	2 49	2 42	2 37	2 31	2 26	16
20	...	...	...	...	4 56	4 48	4 36	4 24	4 12	4 04	3 56	3 48	20
24	...	...	...	...	7 06	6 55	6 38	6 21	6 03	5 52	5 40	5 28	24
28	...	...	...	...	9 40	9 25	9 01	8 37	8 14	7 58	7 43	7 27	28
32	...	...	...	...	12 38	12 17	11 46	11 15	10 45	10 24	10 04	9 44	32
36	...	...	...	...	15 59	15 33	14 55	14 16	13 37	13 11	12 45	12 18	36
40	...	...	...	...	19 44	19 12	18 24	17 36	16 48	16 16	15 44	15 12	40
44	...	...	...	...	23 52	23 14	22 16	21 18	20 20	19 41	19 02	18 24	44
48	...	...	...	...	28 23	27 37	26 29	25 20	24 11	23 25	22 39	21 54	48
52	...	...	...	...	33 21	32 27	31 05	29 44	28 23	27 29	26 35	25 41	52
56	...	...	...	...	38 40	37 38	36 04	34 30	32 56	31 53	30 50	29 48	56
60	...	...	...	...	44 24	43 12	41 24	39 36	37 48	36 36	35 24	34 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	...	0.74	0.72	0.69	0.66	0.63	0.61	0.59	0.57	$\Delta_1 h$
Log.	... ...	... ...	... ...	... ...	9.869 23	9.857 33	9.838 85	9.819 54	9.799 34	9.785 33	9.770 85	9.755 87	Log.
Limit					86	87	87	87	88	89	90	91	Minutes
Meridian	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	Altitudes

Latitude 32° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 51	0 51	0 53	0 54	0 57	0 59	1 00	1 02	1 05	1 07	1 10	1 13	4
8	3 21	3 27	3 33	3 40	3 47	3 53	4 02	4 10	4 19	4 30	4 40	4 52	8
12	7 32	7 45	7 59	8 14	8 30	8 45	9 05	9 23	9 43	10 06	10 31	10 57	12
16	13 24	13 47	14 13	14 38	15 06	15 35	16 07	16 41	17 17	17 58	18 41	19 27	16
20	20 56	21 32	22 12	22 52	23 36	24 20	25 12	26 04	27 00	28 04	29 12	30 24	20
24	30 09	31 00	31 58	32 55	33 59	35 03	36 17	37 32	38 53	40 25	42 03	43 47	24
28	41 01	42 13	43 31	44 50	46 15	47 41	49 24	51 06	52 55	55 01	57 14	59 55	28
32	53 35	55 08	56 50	58 33	60 25	62 17	64 31	66 44	69 07	71 51	74 45	77 49	32
36	67 50	69 46	71 56	74 05	76 28	78 51	...	...	...	...	...	...	36
40	83 44	86 08	88 48	91 28	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.14	3.23	3.33	3.43	3.54	3.65	3.78	3.91	4.05	4.21	4.38	4.56	$\triangle_1 h$
Log.	0.496 93	0.509 20	0.522 44	0.535 29	0.549 00	0.562 29	0.577 49	0.592 18	0.607 46	0.624 28	0.641 47	0.658 96	Log.
Limit	35	34	33	32	32	31	31	30	29	28	28	27	Minutes
Meridian	58°	59°	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 16	1 19	1 23	1 28	1 33	1 39	1 45	1 52	2 00	2 11	2 22	2 37	4
8	5 05	5 18	5 35	5 52	6 12	6 33	6 59	7 28	8 02	8 41	9 29	10 27	8
12	11 26	11 58	12 33	13 12	13 56	14 45	15 43	16 48	18 04	19 33	21 20	23 31	12
16	20 18	21 14	22 19	23 28	24 48	26 15	27 57	29 52	32 08	34 47	37 56	41 49	16
20	31 44	33 12	34 52	36 40	38 44	41 00	43 40	46 40	50 12	54 20	...	...	20
24	45 42	47 48	50 12	52 48	55 47	59 03	62 53	...	...	...	...	...	24
28	62 10	65 03	68 21	71 52	75 55	80 21	...	...	...	...	...	...	28
32	81 14	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.76	4.98	5.23	5.50	5.81	6.15	6.55	7.00	7.53	8.15	8.89	9.80	$\triangle_1 h$
Log.	0.677 61	0.697 23	0.718 50	0.740 36	0.764 18	0.788 88	0.816 24	0.845 10	0.876 79	0.911 16	0.948 90	0.991 23	Log.
Limit	26	25	24	24	23	22	21	20	19	18	16	14	Minutes
Meridian	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 55	3 18	3 50	4 32	...	...	...	...	...	...	...	...	4
8	11 40	13 12	15 18	18 09	...	...	...	...	...	...	...	...	8
12	26 14	29 43	34 22	...	...	...	...	...	...	...	...	...	12
16	46 38	48 33	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	10.93	12.38	14.32	17.02	...	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	1.038 62	1.092 72	1.155 94	1.230 96	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	13	12	10	8	6	5	4	2	0	2	4	5	Minutes
Meridian	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	4 04	3 21	2 50	2 27	2 08	1 54	1 42	1 32	1 23	1 16	1 10	4
8	...	16 17	13 23	11 19	9 46	8 34	7 36	6 48	6 09	5 35	5 06	4 42	8
12	...	...	30 07	25 29	21 59	19 14	17 06	15 19	13 50	12 33	11 29	10 32	12
16	...	...	...	45 19	39 05	34 16	30 26	27 13	24 34	22 19	20 23	18 44	16
20	...	...	...	...	...	53 32	47 32	42 32	38 24	34 52	31 52	29 16	20
24	...	...	...	...	...	...	...	61 15	55 18	50 12	45 53	42 09	24
28	...	...	...	...	...	...	...	...	...	68 21	62 26	57 22	28
32	...	...	...	...	...	...	...	...	...	...	...	74 55	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	15.26	12.55	10.62	9.16	8.03	7.13	6.38	5.76	5.23	4.78	4.39	$\triangle_1 h$
Log.	... ...	1.183 55	1.098 64	1.026 12	0.961 90	0.904 72	0.853 09	0.804 82	0.760 42	0.718 50	0.679 43	0.642 46	Log.
Limit	6	8	10	12	14	15	17	19	21	23	25	26	Minutes
Meridian	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	Altitudes

Latitude 32° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 05	1 00	0 55	0 51	0 48	0 45	0 42	0 39	0 36	0 35	0 32	0 30	4
8	4 19	4 00	3 42	3 26	3 12	2 59	2 47	2 37	2 27	2 17	2 09	2 01	8
12	9 42	8 59	8 19	7 44	7 12	6 43	6 15	5 52	5 30	5 09	4 49	4 32	12
16	17 14	15 57	14 45	13 43	12 48	11 57	11 09	10 24	9 46	9 11	8 35	8 04	16
20	26 56	24 56	23 03	21 28	20 00	18 40	17 24	16 16	15 16	14 20	13 24	12 36	20
24	38 47	35 54	33 13	30 55	28 48	26 53	25 04	23 25	21 59	20 39	19 18	18 09	24
28	52 47	48 52	45 13	42 05	39 12	36 35	34 06	31 53	29 56	28 05	26 16	24 42	28
32	68 57	63 50	59 03	54 57	51 12	47 47	44 32	41 39	39 05	36 41	34 18	32 15	32
36	...	...	74 44	69 33	64 48	60 29	56 23	52 42	49 28	46 27	43 25	40 50	36
40	...	...	...	...	...	74 40	69 36	65 04	61 04	57 20	53 36	50 24	40
44	...	...	...	...	...	...	...	78 43	73 53	69 23	64 51	60 59	44
48	...	...	...	...	...	...	...	...	...	82 33	77 11	72 34	48
52	...	...	...	...	...	...	...	...	...	...	...	85 10	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.04	3.74	3.46	3.22	3.00	2.80	2.61	2.44	2.29	2.15	2.01	1.89	$\triangle_1 h$
Log.	0.606 38	0.572 87	0.539 08	0.507 86	0.477 12	0.447 16	0.416 64	0.387 39	0.359 84	0.332 44	0.303 20	0.276 46	Log.
Limit	27	28	30	31	32	33	35	36	38	40	42	44	Minutes
Meridian	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 27	0 25	0 23	0 22	0 20	0 19	0 18	0 17	0 15	0 14	0 14	4
8	1 54	1 47	1 40	1 34	1 28	1 23	1 17	1 12	1 08	1 03	0 58	0 54	8
12	4 16	4 00	3 45	3 32	3 19	3 06	2 54	2 42	2 33	2 23	2 13	2 02	12
16	7 33	7 08	6 39	6 16	5 53	5 30	5 10	4 50	4 31	4 13	3 55	3 38	16
20	11 48	11 08	10 24	9 48	9 12	8 36	8 04	7 32	7 04	6 36	6 08	5 40	20
24	16 59	16 02	14 59	14 06	13 15	12 23	11 37	10 51	10 11	9 30	8 50	8 10	24
28	23 08	21 49	20 23	19 13	18 02	16 52	15 49	14 46	13 51	12 57	12 02	11 06	28
32	30 13	28 30	26 37	25 06	23 33	22 01	20 39	19 17	18 05	16 54	15 42	14 30	32
36	38 14	36 05	33 42	31 45	29 49	27 52	26 08	24 25	22 54	21 23	19 52	18 22	36
40	47 12	44 32	41 36	39 12	36 48	34 24	32 16	30 08	28 16	26 24	24 32	22 40	40
44	57 07	53 54	50 20	47 26	44 32	41 37	39 02	36 28	34 12	31 56	39 41	27 26	44
48	67 56	64 07	59 54	56 27	52 59	49 32	46 28	43 23	40 42	38 01	35 20	32 28	48
52	79 46	75 15	70 18	66 15	62 11	58 08	54 32	50 55	47 46	44 37	41 28	38 18	52
56	...	87 18	81 32	76 50	72 08	67 25	63 14	59 04	55 24	51 44	48 05	44 26	56
60	...	...	93 36	88 12	82 48	77 24	72 36	67 48	63 36	59 24	55 12	51 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.77	1.67	1.56	1.47	1.38	1.29	1.21	1.13	1.06	0.99	0.92	0.85	$\triangle_1 h$
Log.	0.247 97	0.222 72	0.193 12	0.167 32	0.139 88	0.110 59	0.082 79	0.053 08	0.025 31	9.995 64	9.963 79	9.929 42	Log.
Limit	46	48	50	52	53	54	56	58	60	62	64	66	Minutes
Meridian	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	51°	Altitudes

Latitude 32° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	0 51	0 49	0 47	0 46	0 45	0 44	0 43	0 42	0 41	0 40	0 39	0 38	4
8	3 21	3 16	3 10	3 05	3 01	2 57	2 52	2 48	2 45	2 41	2 37	2 34	8
12	7 32	7 21	7 10	6 58	6 47	6 38	6 27	6 18	6 10	6 01	5 53	5 46	12
16	13 24	13 03	12 42	12 22	12 05	11 46	11 29	11 14	10 58	10 43	10 27	10 14	16
20	20 56	20 24	19 52	19 20	18 52	18 24	17 56	17 32	17 08	16 44	16 20	16 00	20
24	30 09	29 23	28 36	27 50	27 10	26 30	25 50	25 15	24 40	24 06	23 31	23 02	24
28	41 01	39 59	38 57	37 54	36 59	36 04	35 09	34 22	33 35	32 48	32 01	31 22	28
32	53 35	52 13	50 52	49 30	48 18	47 06	45 54	44 53	43 52	42 50	41 49	40 58	32
36	67 50	66 06	64 22	62 38	61 08	59 37	58 07	56 49	55 31	54 13	52 55	51 50	36
40	83 44	81 36	79 28	77 20	75 28	73 36	71 44	70 08	68 32	66 56	65 20	64 00	40
44	...	...	...	...	...	...	86 48	84 52	82 56	80 59	79 03	77 26	44
48	...	...	...	...	...	...	...	...	...	96 23	94 05	92 10	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	3.14	3.06	2.98	2.90	2.83	2.76	2.69	2.63	2.57	2.51	2.45	2.40	$\Delta_1 h$
Log.	0.496 93	0.485 72	0.474 22	0.462 40	0.451 79	0.440 91	0.429 75	0.419 96	0.409 93	0.399 67	0.389 17	0.380 21	Log.
Limit	35	36	37	38	38	39	40	40	41	41	42	42	Minutes
Meridian	58°	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	0 38	0 36	0 36	0 35	0 35	0 34	0 33	0 32	0 31	0 31	0 30	0 30	4
8	2 30	2 27	2 24	2 21	2 17	2 15	2 13	2 10	2 07	2 04	2 02	2 00	8
12	5 37	5 30	5 24	5 17	5 09	5 03	4 58	4 52	4 47	4 41	4 35	4 29	12
16	9 59	9 46	9 36	9 23	9 11	9 01	8 50	8 40	8 29	8 19	8 09	7 59	16
20	15 36	15 16	15 00	14 40	14 20	14 04	13 48	13 32	13 16	13 00	12 44	12 28	20
24	22 28	21 59	21 36	21 07	20 39	20 16	19 52	19 29	19 06	18 43	18 20	17 57	24
28	30 34	29 56	29 24	28 45	28 05	27 34	27 03	26 32	26 01	25 29	24 58	24 26	28
32	39 56	39 05	38 24	37 33	36 41	36 00	35 20	34 39	33 58	33 17	32 36	31 55	32
36	50 33	49 28	48 36	47 31	46 27	45 35	44 43	43 51	42 59	42 07	41 15	40 24	36
40	62 24	61 04	60 00	58 40	57 20	56 16	55 12	54 08	53 04	52 00	50 56	49 52	40
44	75 30	73 53	72 36	70 59	69 23	68 05	66 48	65 30	64 12	62 55	61 37	60 21	44
48	89 51	87 56	86 24	84 29	82 33	81 01	79 29	77 57	76 25	74 53	73 21	71 48	48
52	105 27	103 12	101 24	99 09	96 53	95 05	93 17	91 29	89 41	87 53	86 05	84 16	52
56	...	...	...	...	...	...	...	...	...	101 55	99 49	97 45	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.34	2.29	2.25	2.20	2.15	2.11	2.07	2.03	1.99	1.95	1.91	1.87	$\Delta_1 h$
Log.	0.369 22	0.359 84	0.352 18	0.342 42	0.332 44	0.324 28	0.315 97	0.307 50	0.298 85	0.290 03	0.281 03	0.271 84	Log.
Limit	43	44	45	46	46	47	48	49	49	50	51	52	Minutes
Meridian	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	Altitudes

Latitude 32° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 29	0 28	0 28	0 27	0 27	0 27	0 26	0 26	0 25	0 25	0 24	0 23	4
8	1 57	1 55	1 53	1 51	1 49	1 47	1 44	1 42	1 41	1 39	1 36	1 35	8
12	4 23	4 18	4 14	4 09	4 05	4 00	3 54	3 50	3 46	3 42	3 37	3 34	12
16	7 49	7 38	7 30	7 23	7 15	7 08	6 58	6 50	6 42	6 34	6 27	6 18	16
20	12 12	11 56	11 44	11 32	11 20	11 08	10 52	10 40	10 28	10 16	10 04	9 52	20
24	17 34	17 11	16 54	16 36	16 19	16 02	15 39	15 22	15 04	14 47	14 30	14 12	24
28	23 55	23 24	23 00	22 37	22 13	21 49	21 18	20 54	20 31	20 07	19 44	19 21	28
32	31 13	30 33	30 02	29 22	29 01	28 30	27 49	27 18	26 48	26 17	25 46	25 16	32
36	39 32	38 40	38 01	37 22	36 43	36 05	35 13	34 34	33 55	33 16	32 37	31 58	36
40	48 48	47 44	46 56	46 08	45 20	44 32	43 28	42 40	41 52	41 04	40 16	39 28	40
44	59 03	57 45	56 47	55 49	54 51	53 54	52 36	51 38	50 40	49 41	48 43	47 45	44
48	70 16	68 42	67 33	66 24	65 15	64 07	62 35	61 26	60 17	59 08	57 59	56 50	48
52	82 28	80 40	79 19	77 58	76 37	75 15	73 27	72 06	70 45	69 24	68 03	66 42	52
56	95 39	93 33	91 59	90 25	88 51	87 18	85 12	83 38	82 04	80 29	78 55	77 21	56
60	109 48	107 24	105 36	103 48	102 00	100 12	97 48	96 00	94 12	92 24	90 36	88 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.83	1.79	1.76	1.73	1.70	1.67	1.63	1.60	1.57	1.54	1.51	1.48	$\triangle_1 h$
Log.	0.262 45	0.252 85	0.245 51	0.238 05	0.230 45	0.222 72	0.212 19	0.204 12	0.195 90	0.187 52	0.178 98	0.170 26	Log.
Limit	53	54	54	55	56	57	58	58	59	60	61	62	Minutes
Meridian	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 22	0 22	0 22	0 22	0 21	0 20	0 20	0 20	0 19	0 19	0 19	4
8	1 33	1 31	1 30	1 28	1 26	1 23	1 23	1 21	1 20	1 17	1 15	1 14	8
12	3 29	3 25	3 22	3 17	3 13	3 08	3 06	3 02	2 59	2 54	2 50	2 47	12
16	6 11	6 03	5 58	5 51	5 43	5 36	5 30	5 22	5 17	5 10	5 02	4 57	16
20	9 40	9 28	9 20	9 08	8 56	8 44	8 36	8 24	8 16	8 04	7 52	7 44	20
24	13 55	13 38	13 26	13 09	12 52	12 35	12 23	12 06	11 54	11 37	11 20	11 09	24
28	18 57	18 34	18 18	17 54	17 30	17 07	16 52	16 28	16 12	15 49	15 25	15 09	28
32	24 45	24 14	23 54	23 23	22 52	22 21	22 01	21 30	21 10	20 39	20 08	19 47	32
36	31 19	30 40	30 14	29 36	28 57	28 18	27 52	27 13	26 47	26 08	25 30	25 04	36
40	38 40	37 52	37 20	36 32	35 44	34 56	34 24	33 36	33 04	32 16	31 28	30 56	40
44	46 47	45 49	45 10	44 13	43 14	42 16	41 37	40 39	40 00	39 02	38 05	37 26	44
48	55 41	54 32	53 46	52 36	51 27	50 18	49 32	48 23	47 37	46 28	45 18	44 52	48
52	65 21	64 00	63 06	61 44	60 23	59 02	58 08	56 47	55 53	54 32	53 10	52 16	52
56	75 47	74 13	73 10	71 37	70 02	68 28	67 25	65 51	64 48	63 14	61 41	60 38	56
60	87 00	85 12	84 00	82 12	80 24	78 36	77 24	75 36	74 24	72 36	70 48	69 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.45	1.42	1.40	1.37	1.34	1.31	1.29	1.26	1.24	1.21	1.18	1.16	$\triangle_1 h$
Log.	0.161 37	0.152 29	0.146 13	0.136 72	0.127 10	0.117 27	0.110 59	0.100 37	0.093 42	0.082 79	0.071 88	0.064 46	Log.
Limit	62	63	65	66	67	68	69	70	71	71	72	73	Minutes
Meridian	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 18	0 17	0 17	0 16	0 16	...	...	...	...	...	...	4
8	1 12	1 11	1 10	1 08	1 06	1 04	...	...	...	...	...	...	8
12	2 42	2 39	2 37	2 33	2 28	2 25	...	...	...	...	...	...	12
16	4 50	4 45	4 39	4 31	4 24	4 19	...	...	...	...	...	...	16
20	7 32	7 24	7 16	7 04	6 52	6 44	...	...	...	...	...	...	20
24	10 51	10 40	10 28	10 11	9 53	9 42	...	...	...	...	...	...	24
28	14 46	14 30	14 15	13 51	13 28	13 12	...	...	...	...	...	...	28
32	19 17	18 56	18 36	18 05	17 35	17 14	...	...	...	...	...	...	32
36	24 25	23 59	23 33	22 54	22 15	21 49	...	...	...	...	...	...	36
40	30 08	29 36	29 04	28 16	27 28	26 56	...	...	...	...	...	...	40
44	36 28	35 49	35 10	34 12	33 14	32 35	...	...	...	...	...	...	44
48	43 23	42 37	41 51	40 42	39 33	38 47	...	...	...	...	...	...	48
52	50 55	50 01	49 07	47 46	46 25	45 31	...	...	...	...	...	...	52
56	59 04	58 01	56 58	55 24	53 50	52 47	...	...	...	...	...	...	56
60	67 48	66 36	65 24	63 36	61 48	60 36	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.13	1.11	1.09	1.06	1.03	1.01	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.053 08	0.045 32	0.037 43	0.025 31	0.012 84	0.004 32	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	73	74	75	76	77	78							Minutes
Meridian	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	0 12	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	4
8	...	...	...	0 49	0 47	0 45	0 43	0 42	0 40	0 38	0 37	0 36	8
12	...	...	...	1 50	1 45	1 42	1 37	1 35	1 30	1 26	1 24	1 21	12
16	...	...	...	3 14	3 07	3 02	2 54	2 49	2 42	2 34	2 28	2 23	16
20	...	...	...	5 04	4 52	4 44	4 32	4 24	4 12	4 00	3 52	3 44	20
24	...	...	...	7 18	7 00	6 49	6 32	6 21	6 03	5 46	5 32	5 23	24
28	...	...	...	9 56	9 33	9 17	8 53	8 37	8 14	7 50	7 35	7 19	28
32	...	...	...	12 58	12 28	12 07	11 36	11 15	10 45	10 14	9 54	9 33	32
36	...	...	...	16 25	15 46	15 20	14 42	14 16	13 37	12 58	12 32	12 06	36
40	...	...	...	20 16	19 28	18 56	18 08	17 36	16 48	16 00	15 28	14 56	40
44	...	...	...	24 31	23 33	22 54	21 57	21 18	20 20	19 22	18 43	18 04	44
48	...	...	...	29 09	28 00	27 14	26 08	25 20	24 11	23 02	22 16	21 30	48
52	...	...	...	34 15	32 54	32 00	30 38	29 44	28 23	27 02	26 09	25 14	52
56	...	...	...	39 43	38 09	37 06	35 33	34 30	32 56	31 22	30 19	29 16	56
60	...	...	...	45 36	43 48	42 36	40 48	39 36	37 48	36 00	34 48	33 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	0.76	0.73	0.71	0.68	0.66	0.63	0.60	0.58	0.56	$\triangle_1 h$
Log.	... ...	... ...	... ...	9.880 81	9.863 32	9.851 26	9.832 51	9.819 54	9.799 34	9.778 15	9.763 43	9.748 19	Log.
Limit				85	86	86	87	87	88	88	89	90	Minutes
Meridian	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 48	0 50	0 51	0 52	0 54	0 55	0 58	0 59	1 02	1 04	1 07	1 09	4
8	3 13	3 19	3 25	3 31	3 37	3 44	3 51	4 00	4 07	4 16	4 25	4 36	8
12	7 15	7 27	7 41	7 54	8 08	8 23	8 39	8 57	9 16	9 36	9 57	10 22	12
16	12 53	13 17	13 39	14 02	14 28	14 53	15 25	15 55	16 28	17 04	17 43	18 26	16
20	20 08	20 44	21 20	21 56	22 36	23 16	24 04	24 52	25 44	26 40	27 40	28 48	20
24	29 00	29 52	30 43	31 35	32 33	33 30	34 40	35 48	37 04	38 24	39 51	41 29	24
28	39 28	40 38	41 49	43 00	44 18	45 37	47 10	48 45	50 26	52 16	54 13	56 27	28
32	51 32	53 04	54 37	56 09	57 51	59 34	61 36	63 40	65 52	68 16	70 49	73 43	32
36	65 14	67 11	69 07	71 04	73 14	75 23	77 59	...	...	...	...	...	36
40	80 32	82 56	85 20	87 44	90 24	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.02	3.11	3.20	3.29	3.39	3.49	3.61	3.73	3.86	4.00	4.15	4.32	$\triangle_1 h$
Log.	0.480 01	0.492 76	0.505 15	0.517 20	0.530 20	0.542 83	0.557 51	0.571 71	0.586 59	0.602 06	0.618 05	0.635 48	Log.
Limit	36	35	34	33	32	32	32	31	30	29	29	28	Minutes
Meridian	57°	58°	59°	60°	61°	62°	63°	64°	65°	66°	67°	68°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 11	1 15	1 18	1 23	1 26	1 31	1 37	1 43	1 50	1 58	2 08	2 19	4
8	4 48	5 00	5 14	5 29	5 47	6 06	6 27	6 53	7 20	7 53	8 32	9 19	8
12	10 47	11 15	11 47	12 21	12 59	13 42	14 31	15 28	16 31	17 44	19 12	20 57	12
16	19 09	20 01	20 57	21 59	23 05	24 22	25 49	27 28	29 21	31 32	34 08	37 15	16
20	29 56	31 16	32 44	34 20	36 04	38 04	40 20	42 56	45 52	49 16	53 20	58 12	20
24	43 05	45 02	47 08	49 27	51 56	54 49	58 05	61 49	66 03	...	...	...	24
28	58 41	61 17	64 10	67 17	70 42	74 37	79 03	84 09	...	...	...	...	28
32	76 38	80 02	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.49	4.69	4.91	5.15	5.41	5.71	6.05	6.44	6.88	7.39	8.00	8.73	$\triangle_1 h$
Log.	0.652 25	0.671 17	0.691 08	0.711 81	0.733 20	0.756 64	0.781 76	0.808 89	0.837 59	0.868 64	0.903 09	0.941 01	Log.
Limit	27	26	25	25	24	23	22	20	19	18	17	16	Minutes
Meridian	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 34	2 55	3 15	3 45	4 27	...	...	...	...	...	...	...	4
8	10 15	11 26	12 57	14 59	17 47	...	...	...	...	...	...	...	8
12	23 05	25 44	29 08	33 42	...	...	...	...	...	...	...	...	12
16	41 03	45 44	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	9.62	10.72	12.14	14.04	16.68	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.983 18	1.030 19	1.084 22	1.147 37	1.222 20	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	14	13	11	9	8	7	5	3	2	0	2	4	Minutes
Meridian	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	3 58	3 16	2 46	2 22	2 05	1 51	1 39	1 30	1 21	1 14	4
8	...	...	15 53	13 04	11 02	9 31	8 20	7 24	6 38	5 58	5 25	4 57	8
12	...	...	35 44	29 23	24 50	21 26	18 46	16 40	14 54	13 26	12 12	11 08	12
16	...	...	...	46 53	44 10	38 06	33 22	29 36	26 30	23 54	21 40	19 48	16
20	...	...	...	...	...	59 32	52 08	46 16	41 24	37 20	33 52	30 56	20
24	...	...	...	...	...	...	...	66 37	59 37	53 46	48 46	44 33	24
28	...	...	...	...	...	...	...	...	...	...	...	60 37	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	14.89	12.24	10.35	8.93	7.82	6.94	6.21	5.60	5.08	4.64	$\triangle_1 h$
Log.	... ...	... ...	1.172 89	1.087 78	1.014 94	0.950 85	0.893 21	0.841 36	0.793 09	0.748 19	0.705 86	0.666 52	Log.
Limit	6	8	10	12	13	15	17	19	20	21	23	25	Minutes
Meridian	87°	86°	85	84°	83°	82°	81°	80°	79°	78°	77°	76°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 08	1 02	0 58	0 54	0 50	0 47	0 43	0 40	0 38	0 35	0 33	0 30	4
8	4 33	4 10	3 51	3 34	3 19	3 05	2 53	2 41	2 31	2 22	2 12	2 03	8
12	10 14	9 25	8 41	8 02	7 27	6 58	6 29	6 03	5 40	5 18	4 57	4 38	12
16	18 10	16 43	15 27	14 18	13 17	12 22	11 31	10 45	10 04	9 26	8 47	8 14	16
20	28 24	26 08	24 08	22 20	20 44	19 20	18 00	16 48	15 44	14 44	13 44	12 52	20
24	40 54	37 38	34 46	32 10	29 52	27 50	25 55	24 12	22 40	21 13	19 47	18 31	24
28	55 40	51 14	47 18	43 46	40 38	37 54	35 17	32 56	30 50	28 53	26 55	25 14	28
32	72 42	66 54	61 46	57 10	53 04	49 30	46 05	43 00	40 16	37 43	35 09	32 57	32
36	...	...	78 12	72 22	67 11	62 38	58 19	54 26	50 59	47 44	44 30	41 41	36
40	...	...	...	...	...	77 20	72 00	67 12	62 56	58 56	54 56	51 28	40
44	...	...	...	...	...	...	...	81 19	76 09	71 18	66 28	62 16	44
48	...	...	...	...	...	...	...	...	...	84 52	79 06	74 07	48
52	...	...	...	...	...	...	...	...	...	...	...	86 59	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	4.26	3.92	3.62	3.35	3.11	2.90	2.70	2.52	2.36	2.21	2.06	1.93	$\triangle_1$h
Log.	0.629 41	0.593 29	0.558 71	0.525 04	0.492 76	0.462 40	0.431 36	0.401 40	0.372 91	0.344 39	0.313 87	0.285 56	Log.
Limit	26	27	29	31	32	33	34	36	38	40	42	43	Minutes
Meridian	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 29	0 27	0 25	0 24	0 22	0 21	0 19	0 19	0 17	0 16	0 14	0 14	4
8	1 56	1 49	1 42	1 36	1 30	1 23	1 19	1 13	1 09	1 04	0 59	0 54	8
12	4 20	4 05	3 49	3 36	3 22	3 08	2 57	2 45	2 36	2 25	2 14	2 02	12
16	7 44	7 15	6 47	6 24	5 58	5 36	5 15	4 55	4 36	4 19	3 58	3 38	16
20	12 04	11 20	10 36	10 00	9 20	8 44	8 12	7 40	7 12	6 44	6 12	5 40	20
24	17 23	16 19	15 16	14 24	13 26	12 35	11 48	11 03	10 22	9 42	8 55	8 10	24
28	23 39	22 13	20 47	19 36	18 18	17 07	16 05	15 01	14 07	13 12	12 10	11 06	28
32	30 53	29 01	27 08	25 36	23 54	22 21	21 00	19 37	18 26	17 14	15 53	14 30	32
36	39 06	36 43	34 21	32 24	30 14	28 18	26 34	24 51	23 20	21 49	20 05	18 22	36
40	48 16	45 20	42 24	40 00	37 20	34 56	32 48	30 40	28 48	26 56	24 48	22 40	40
44	58 24	54 51	51 18	48 24	45 10	42 16	39 41	37 07	34 51	32 35	30 00	27 26	44
48	69 30	65 15	61 03	57 36	53 46	50 18	47 14	44 09	41 28	38 47	35 43	32 38	48
52	81 34	76 37	71 39	67 36	63 06	59 02	55 26	51 49	48 40	45 31	41 55	38 18	52
56	...	88 51	83 06	78 24	73 10	68 28	64 17	60 07	56 27	52 47	48 36	44 26	56
60	...	...	...	90 00	84 00	78 36	73 48	69 00	64 48	60 36	55 48	51 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.81	1.70	1.59	1.50	1.40	1.31	1.23	1.15	1.08	1.01	0.93	0.85	$\triangle_1$h
Log.	0.257 68	0.230 45	0.201 40	0.176 09	0.146 13	0.117 27	0.089 91	0.060 70	0.033 42	0.004 32	9.968 48	9.929 42	Log.
Limit	45	46	48	50	51	53	55	57	59	61	63	65	Minutes
Meridian	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	52°	Altitudes

Latitude 33° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 48	0 47	0 46	0 45	0 43	0 43	0 42	0 41	0 39	0 38	0 38	0 37	4
8	3 13	3 08	3 04	2 59	2 55	2 50	2 46	2 43	2 40	2 36	2 32	2 29	8
12	7 15	7 04	6 53	6 43	6 33	6 23	6 14	6 06	5 59	5 50	5 43	5 35	12
16	12 53	12 32	12 15	11 57	11 39	11 21	11 06	10 50	10 37	10 22	10 09	9 57	16
20	20 08	19 36	19 08	18 40	18 12	17 44	17 20	16 56	16 36	16 12	15 52	15 32	20
24	29 00	28 13	27 33	26 53	26 12	25 33	24 58	24 23	23 54	23 19	22 51	22 22	24
28	39 28	38 25	37 30	36 35	35 41	34 45	33 58	33 11	32 33	31 46	31 06	30 27	28
32	51 32	50 11	48 59	47 47	46 36	45 23	44 22	43 21	42 30	41 29	40 37	39 46	32
36	65 14	63 30	62 00	60 29	58 58	57 28	56 10	54 52	53 47	52 29	51 25	50 20	36
40	80 32	78 24	76 32	74 40	72 48	70 56	69 20	67 44	66 24	64 48	63 28	62 08	40
44	...	...	...	...	88 05	85 50	83 54	81 57	80 20	78 24	76 48	75 11	44
48	...	...	...	...	...	...	...	...	95 37	93 19	91 23	89 28	48
52	...	...	...	...	...	...	...	...	...	...	107 15	105 00	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.02	2.94	2.87	2.80	2.73	2.66	2.60	2.54	2.49	2.43	2.38	2.33	$\triangle_1$h
Log.	0.480 01	0.468 35	0.457 88	0.447 16	0.436 16	0.424 88	0.414 97	0.404 83	0.396 20	0.385 61	0.376 58	0.367 36	Log.
Limit	36	36	37	38	39	40	40	41	41	42	42	43	Minutes
Meridian	57°	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 36	0 35	0 35	0 35	0 34	0 33	0 32	0 31	0 31	0 30	0 30	0 29	4
8	2 26	2 23	2 19	2 17	2 14	2 12	2 09	2 06	2 04	2 01	1 59	1 57	8
12	5 29	5 21	5 14	5 08	5 02	4 57	4 51	4 46	4 40	4 34	4 28	4 23	12
16	9 43	9 31	9 18	9 08	8 58	8 47	8 37	8 26	8 16	8 06	7 56	7 49	16
20	15 12	14 52	14 32	14 16	14 00	13 44	13 28	13 12	12 56	12 40	12 24	12 12	20
24	21 53	21 24	20 56	20 33	20 10	19 47	19 24	19 00	18 37	18 14	17 52	17 34	24
28	29 48	29 09	28 29	27 57	27 26	26 55	26 24	25 53	25 21	24 50	24 18	23 55	28
32	38 55	38 04	37 12	36 31	35 50	35 09	34 28	33 48	33 07	32 26	31 44	31 13	32
36	49 15	48 10	47 06	46 14	45 22	44 30	43 38	42 46	41 54	41 02	40 11	39 32	36
40	60 48	59 28	58 08	57 04	56 00	54 56	53 52	52 48	51 44	50 40	49 36	48 48	40
44	73 34	71 57	70 21	69 03	67 46	66 28	65 11	63 53	62 35	61 18	60 01	59 03	44
48	87 33	85 38	83 42	82 10	80 38	79 06	67 34	76 02	74 30	72 58	71 25	70 16	48
52	102 45	100 30	98 14	96 26	94 38	92 50	91 02	89 14	87 26	85 38	83 49	82 28	52
56	...	...	...	...	...	...	105 35	103 29	101 23	99 18	97 13	95 39	56
60	...	...	...	...	...	...	...	...	...	114 00	111 36	109 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.28	2.23	2.18	2.14	2.10	2.06	2.02	1.98	1.94	1.90	1.86	1.83	$\triangle_1$h
Log.	0.357 93	0.348 30	0.338 46	0.330 41	0.322 22	0.313 87	0.305 35	0.296 67	0.287 80	0.278 75	0.269 51	0.262 45	Log.
Limit	44	45	46	47	47	48	48	49	50	51	52	53	Minutes
Meridian	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	Altitudes

Latitude 33° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 28	0 27	0 27	0 27	0 26	0 26	0 25	0 25	0 24	0 23	0 23	4
8	1 55	1 52	1 50	1 48	1 46	1 44	1 42	1 41	1 39	1 36	1 35	1 34	8
12	4 18	4 12	4 08	4 03	3 59	3 54	3 50	3 46	3 42	3 37	3 34	3 31	12
16	7 38	7 28	7 20	7 13	7 05	6 58	6 50	6 42	6 34	6 27	6 18	6 13	16
20	11 56	11 40	11 28	11 16	11 04	10 52	10 40	10 28	10 16	10 04	9 52	9 44	20
24	17 11	16 48	16 31	16 14	15 57	15 39	15 22	15 04	14 47	14 30	14 12	14 01	24
28	23 24	22 52	22 29	22 05	21 41	21 18	20 54	20 31	20 07	19 44	19 21	19 05	28
32	30 33	29 52	29 21	28 50	28 19	27 49	27 18	26 48	26 17	25 46	25 16	24 55	32
36	38 40	37 48	37 09	36 31	35 52	35 13	34 34	33 55	33 16	32 37	31 58	31 32	36
40	47 44	46 40	45 52	45 04	44 16	43 28	42 40	41 52	41 04	40 16	39 28	38 56	40
44	57 45	56 28	55 30	54 32	53 34	52 36	51 38	50 40	49 41	48 43	47 45	47 06	44
48	68 42	67 10	66 01	64 53	63 44	62 35	61 26	60 17	59 08	57 59	56 50	56 04	48
52	80 40	78 52	77 31	76 09	74 48	73 27	72 06	70 45	69 24	68 03	66 42	65 48	52
56	...	...	89 54	88 20	86 46	85 12	83 38	82 04	80 29	78 55	77 21	76 18	56
60	...	...	...	...	...	...	96 00	94 12	92 24	90 36	88 48	87 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.79	1.75	1.72	1.69	1.66	1.63	1.60	1.57	1.54	1.51	1.48	1.46	$\triangle_1$h
Log.	0.252 85	0.243 04	0.235 53	0.227 89	0.220 11	0.212 19	0.204 12	0.195 90	0.187 52	0.178 98	0.170 26	0.164 35	Log.
Limit	54	54	55	56	57	58	59	59	60	61	62	63	Minutes
Meridian	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 22	0 21	0 20	0 20	0 20	0 19	0 19	0 19	0 18	4
8	1 32	1 30	1 28	1 26	1 24	1 23	1 21	1 20	1 18	1 16	1 15	1 13	8
12	3 24	3 22	3 17	3 14	3 10	3 06	3 03	2 59	2 56	2 51	2 48	2 44	12
16	6 06	5 58	5 51	5 46	5 38	5 30	5 25	5 17	5 12	5 05	5 00	4 52	16
20	9 32	9 20	9 08	9 00	8 48	8 36	8 28	8 16	8 08	7 56	7 48	7 36	20
24	13 43	13 26	13 09	12 58	12 41	12 23	12 11	11 54	11 43	11 26	11 14	10 57	24
28	18 42	18 18	17 54	17 38	17 15	16 52	16 36	16 12	15 57	15 33	15 17	14 53	28
32	24 25	23 54	23 23	23 02	22 31	22 01	21 41	21 10	20 49	20 18	19 58	19 27	32
36	30 53	30 14	29 36	29 10	28 31	27 52	27 26	26 47	26 21	25 43	25 17	24 38	36
40	38 08	37 20	36 32	36 00	35 12	34 24	33 52	33 04	32 32	31 44	31 12	30 24	40
44	46 08	45 10	44 13	43 34	42 36	41 37	40 59	40 00	39 22	38 24	37 46	36 47	44
48	54 55	53 46	52 36	51 50	50 41	49 32	48 46	47 37	46 51	45 41	44 55	43 46	48
52	64 27	63 06	61 44	60 50	59 29	58 08	57 14	55 53	54 59	53 37	52 43	51 22	52
56	74 44	73 10	71 37	70 34	69 00	67 25	66 23	64 48	63 46	62 12	61 10	59 35	56
60	85 48	84 00	82 12	81 00	79 12	77 24	76 12	74 24	73 12	71 24	70 12	68 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.43	1.40	1.37	1.35	1.32	1.29	1.27	1.24	1.22	1.19	1.17	1.14	$\triangle_1$h
Log.	0.155 34	0.146 13	0.136 72	0.130 33	0.120 57	0.110 59	0.103 80	0.093 42	0.086 36	0.075 55	0.068 19	0.056 90	Log.
Limit	64	65	66	67	68	69	70	71	72	72	73	74	Minutes
Meridian	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	Altitudes

Latitude 33° Declination Contrary Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 17	0 17	0 17	0 16	...	...	...	...	...	...	...	4
8	1 11	1 10	1 08	1 07	1 05	...	...	...	...	...	...	...	8
12	2 41	2 37	2 34	2 31	2 27	...	...	...	...	...	...	...	12
16	4 47	4 39	4 34	4 29	4 21	...	...	...	...	...	...	...	16
20	7 28	7 16	7 08	7 00	6 48	...	...	...	...	...	...	...	20
24	10 46	10 28	10 16	10 05	9 48	...	...	...	...	...	...	...	24
28	14 38	14 15	13 59	13 43	13 20	...	...	...	...	...	...	...	28
32	19 06	18 36	18 16	17 55	17 24	...	...	...	...	...	...	...	32
36	24 12	23 33	23 07	22 41	22 02	...	...	...	...	...	...	...	36
40	29 52	29 04	28 32	28 00	27 12	...	...	...	...	...	...	...	40
44	36 09	35 10	34 32	33 53	32 55	...	...	...	...	...	...	...	44
48	43 00	41 51	41 05	40 19	39 10	...	...	...	...	...	...	...	48
52	50 28	49 07	48 13	47 19	45 58	...	...	...	...	...	...	...	52
56	58 33	56 58	55 56	54 53	53 19	...	...	...	...	...	...	...	56
60	67 12	65 24	64 12	63 00	61 12	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.12	1.09	1.07	1.05	1.02	...	...	...	...	...	...	...	△₁h
Log.	0.049 22	0.037 43	0.029 38	0.021 19	0.008 60	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	75	75	76	77	77								Minutes
Meridian	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	0 12	0 12	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	4
8	...	...	0 50	0 48	0 46	0 45	0 43	0 42	0 39	0 38	0 37	0 36	8
12	...	...	1 51	1 48	1 44	1 41	1 37	1 35	1 29	1 26	1 24	1 21	12
16	...	...	3 17	3 12	3 04	2 59	2 54	2 49	2 39	2 34	2 28	2 23	16
20	...	...	5 08	5 00	4 48	4 40	4 32	4 24	4 08	4 00	3 52	3 44	20
24	...	...	7 23	7 12	6 55	6 43	6 32	6 21	5 58	5 46	5 32	5 23	24
28	...	...	10 04	9 48	9 25	9 09	8 53	8 37	8 06	7 50	7 35	7 19	28
32	...	...	13 09	12 48	12 17	11 57	11 36	11 15	10 34	10 14	9 54	9 33	32
36	...	...	16 38	16 12	15 33	15 07	14 42	14 16	13 24	12 58	12 32	12 06	36
40	...	...	20 32	20 00	19 12	18 40	18 08	17 36	16 32	16 00	15 28	14 56	40
44	...	...	24 51	24 12	23 14	22 35	21 57	21 18	20 01	19 22	18 43	18 04	44
48	...	...	29 32	28 46	27 37	26 51	26 06	25 20	23 48	23 02	22 16	21 30	48
52	...	...	34 42	33 48	32 27	31 33	30 38	29 44	27 56	27 02	26 09	25 14	52
56	...	...	40 15	39 12	37 38	36 35	35 33	34 30	32 25	31 22	30 19	29 16	56
60	...	...	46 12	45 00	43 12	42 00	40 48	39 36	37 12	36 00	34 48	33 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	...	...	0.77	0.75	0.72	0.70	0.68	0.66	0.63	0.60	0.58	0.56	△₁h
Log.	... ...	... ...	9.886 49	9.875 06	9.857 33	9.845 10	9.832 51	9.819 54	9.799 34	9.778 15	9.763 43	9.748 19	Log.
Limit			84	85	86	86	87	87	88	88	89	89	Minutes
Meridian	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	Altitudes

Latitude 34° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 46	0 47	0 49	0 51	0 52	0 54	0 55	0 57	0 59	1 01	1 03	1 05	4
8	3 06	3 11	3 17	3 22	3 28	3 34	3 41	3 48	3 55	4 03	4 12	4 22	8
12	6 59	7 11	7 22	7 35	7 48	8 01	8 17	8 33	8 50	9 07	9 28	9 49	12
16	12 25	12 45	13 06	13 29	13 52	14 15	14 43	15 11	15 42	16 13	16 48	17 27	16
20	19 24	19 56	20 28	21 04	21 40	22 16	23 00	23 44	24 32	25 20	26 16	27 16	20
24	27 56	28 42	29 28	30 21	31 12	32 04	33 07	34 11	35 20	36 29	37 49	39 16	24
28	38 02	39 05	40 07	41 17	42 28	43 38	45 05	46 31	48 05	49 39	51 29	53 27	28
32	49 40	51 02	52 24	53 55	55 28	57 00	58 53	60 45	62 48	64 51	67 15	69 48	32
36	62 51	64 35	66 19	68 16	70 12	72 09	74 31	76 54	79 30	...	...	...	36
40	77 36	79 44	81 52	84 16	86 40	89 04	92 00	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.91	2.99	3.07	3.16	3.25	3.34	3.45	3.56	3.68	3.80	3.94	4.09	$\Delta_1 h$
Log.	0.463 89	0.475 67	0.487 14	0.499 69	0.511 88	0.523 75	0.537 82	0.551 45	0.565 85	0.579 78	0.595 50	0.611 72	Log.
Limit	37	36	35	34	33	33	33	32	31	30	30	29	Minutes
Meridian	56°	57°	58°	59°	60°	61°	62°	63°	64°	65°	66°	67°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 08	1 10	1 14	1 17	1 21	1 25	1 30	1 35	1 41	1 49	1 56	2 06	4
8	4 32	4 44	4 55	5 09	5 24	5 40	5 59	6 20	6 44	7 13	7 45	8 22	8
12	10 12	10 38	11 05	11 35	12 09	12 46	13 27	14 17	15 10	16 14	17 26	18 50	12
16	18 08	18 54	19 43	20 37	21 35	22 42	23 57	25 23	26 58	28 50	30 58	33 30	16
20	28 20	29 22	30 48	32 12	33 44	35 28	37 24	39 40	42 08	45 04	48 24	52 20	20
24	40 48	42 31	44 22	46 22	48 35	51 05	53 52	57 07	60 41	64 54	...	...	24
28	55 32	57 54	60 22	63 07	66 07	69 31	73 18	77 45	82 35	...	...	...	28
32	72 32	75 37	78 50	82 26	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	4.25	4.43	4.62	4.83	5.06	5.32	5.61	5.95	6.32	6.76	7.26	7.85	$\Delta_1 h$
Log.	0.628 39	0.646 40	0.664 64	0.683 95	0.704 15	0.725 91	0.748 96	0.774 52	0.800 72	0.829 95	0.860 94	0.894 87	Log.
Limit	28	27	26	26	25	24	23	22	21	20	19	17	Minutes
Meridian	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 17	2 30	2 48	3 10	3 40	4 22	...	...	...	...	...	...	4
8	9 08	10 04	11 13	12 41	14 41	17 26	...	...	...	...	...	...	8
12	20 33	22 38	25 13	28 34	33 00	39 10	...	...	...	...	...	...	12
16	36 31	40 14	44 51	...	...	...	...	...	...	...	...	...	16
20	57 04	62 52	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	8.56	9.43	10.51	11.90	13.75	16.34	...	...	...	...	...	...	$\triangle_1$h
Log.	0.932 47	0.974 51	1.021 60	1.075 55	1.138 30	1.213 25	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	15	14	13	12	10	8	7	6	4	2	0	2	Minutes
Meridian	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	3 52	3 11	2 41	2 19	2 02	1 48	1 36	1 27	1 18	4
8	...	...	...	15 28	12 43	10 45	9 16	8 07	7 12	6 26	5 49	5 15	8
12	...	...	...	34 49	28 38	24 12	20 51	18 15	16 11	14 28	13 04	11 50	12
16	...	...	...	...	...	43 00	37 05	32 29	28 45	25 44	23 12	21 02	16
20	...	...	...	...	...	...	57 56	50 44	44 56	40 12	36 16	32 52	20
24	...	...	...	...	...	...	...	...	64 42	57 54	52 13	47 19	24
28	...	...	...	...	...	...	...	...	...	...	...	64 26	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	14.51	11.93	10.08	8.69	7.61	6.74	6.03	5.44	4.93	$\triangle_1$h
Log.	... ...	... ...	... ...	1.161 67	1.076 64	1.003 46	0.939 02	0.881 38	0.828 66	0.780 32	0.735 60	0.692 85	Log.
Limit	4	6	8	10	11	13	15	17	19	20	22	24	Minutes
Meridian	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	Altitudes

Latitude 34° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 12	1 06	1 01	0 56	0 52	0 48	0 44	0 42	0 38	0 36	0 34	0 31	4
8	4 48	4 23	4 03	3 44	3 28	3 13	2 59	2 46	2 36	2 26	2 15	2 06	8
12	10 48	9 53	9 07	8 24	7 47	7 13	6 42	6 14	5 50	5 27	5 05	4 46	12
16	19 12	17 35	16 13	14 56	13 49	12 51	11 54	11 06	10 22	9 41	9 03	8 26	16
20	30 00	27 28	25 20	23 20	21 36	20 04	18 36	17 20	16 12	15 08	14 08	13 12	20
24	43 12	39 34	36 29	33 36	31 06	28 54	26 47	24 58	23 19	21 47	20 22	19 00	24
28	58 48	53 50	49 39	45 44	42 20	39 20	36 28	33 58	31 46	29 40	27 42	25 53	28
32	76 48	70 18	64 51	59 44	55 18	51 22	47 37	44 22	41 29	38 45	36 10	33 48	32
36	. . .	. . .	. . .	75 36	69 59	65 01	60 16	56 10	52 29	49 02	45 48	42 46	36
40	. . .	. . .	. . .	. . .	. . .	80 16	74 24	69 20	64 48	60 32	56 32	52 48	40
44	. . .	. . .	. . .	. . .	. . .	. . .	. . .	83 54	78 24	73 15	68 25	63 53	44
48	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	87 10	81 24	76 02	48
52	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	89 14	52
56	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	56
60	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	4.50	4.12	3.80	3.50	3.24	3.01	2.79	2.60	2.43	2.27	2.12	1.98	$\triangle_1$h
Log.	0.653 21	0.614 90	0.579 78	0.544 07	0.510 55	0.478 57	0.445 60	0.414 97	0.385 61	0.356 03	0.326 34	0.296 67	Log.
Limit	26	27	28	30	31	32	33	35	36	38	40	42	Minutes
Meridian	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 28	0 26	0 24	0 22	0 21	0 20	0 19	0 17	0 16	0 15	0 14	4
8	1 59	1 52	1 44	1 37	1 32	1 25	1 20	1 15	1 10	1 05	1 00	0 56	8
12	4 28	4 11	3 54	3 39	3 24	3 11	3 00	2 48	2 37	2 27	2 17	2 07	12
16	7 56	7 24	6 58	6 29	6 06	5 41	5 20	5 00	4 39	4 21	4 03	3 45	16
20	12 24	11 36	10 52	10 08	9 32	8 52	8 20	7 48	7 16	6 48	6 20	5 52	20
24	17 52	16 42	15 39	14 36	13 43	12 46	12 00	11 14	10 28	9 48	9 07	8 27	24
28	24 18	22 44	21 18	19 52	18 42	17 23	16 20	15 17	14 15	13 20	12 25	11 30	28
32	31 44	29 42	27 49	25 56	24 25	22 42	21 20	19 58	18 36	17 24	16 13	15 01	32
36	40 11	37 35	35 13	32 50	30 53	28 44	27 00	25 17	23 33	22 02	20 31	19 01	36
40	49 36	46 24	43 28	40 32	38 08	35 28	33 20	31 12	29 04	27 12	25 20	23 28	40
44	60 01	56 08	52 36	49 03	46 08	42 55	40 20	37 46	35 10	32 55	30 39	28 24	44
48	71 25	66 47	62 35	58 22	54 55	51 04	48 00	44 55	41 51	39 10	36 29	33 47	48
52	83 49	78 25	73 27	68 30	64 27	59 56	56 20	52 43	49 07	45 58	42 49	39 39	52
56	. . .	. . .	85 12	79 27	74 44	69 31	65 20	61 10	56 58	53 19	49 39	46 00	56
60	. . .	. . .	. . .	91 12	85 48	79 48	75 00	70 12	65 24	61 12	57 00	52 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.86	1.74	1.63	1.52	1.43	1.33	1.25	1.17	1.09	1.02	0.95	0.88	$\triangle_1$h
Log.	0.269 51	0.240 55	0.212 19	0.181 84	0.155 34	0.123 85	0.096 91	0.068 19	0.037 43	0.008 60	9.977 72	9.944 48	Log.
Limit	44	45	47	49	51	52	54	56	58	60	62	64	Minutes
Meridian	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	53°	Altitudes

Latitude 34° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 46	0 46	0 44	0 43	0 43	0 41	0 40	0 39	0 38	0 38	0 37	0 36	4
8	3 06	3 02	2 58	2 53	2 49	2 45	2 41	2 38	2 35	2 31	2 28	2 25	8
12	6 59	6 49	6 39	6 29	6 20	6 12	6 03	5 55	5 47	5 40	5 32	5 26	12
16	12 25	12 07	11 49	11 31	11 16	11 00	10 45	10 29	10 17	10 04	9 52	9 38	16
20	19 24	18 56	18 28	18 00	17 36	17 12	16 48	16 24	16 04	15 44	15 24	15 04	20
24	27 56	27 16	26 35	25 55	25 21	24 46	24 12	23 37	23 08	22 40	22 11	21 42	24
28	38 02	37 06	36 12	35 17	34 29	33 43	32 56	32 09	31 30	30 50	30 11	29 32	28
32	49 40	48 28	47 17	46 05	45 03	44 02	43 00	41 59	41 08	40 16	39 25	38 34	32
36	62 51	61 21	59 50	58 19	57 02	55 44	54 26	53 08	52 03	50 59	49 54	48 49	36
40	77 36	75 44	73 52	72 00	70 24	68 48	67 12	65 36	64 16	62 56	61 36	60 16	40
44	...	...	...	87 07	85 11	83 15	81 19	79 22	77 45	76 09	74 32	72 55	44
48	...	...	...	...	...	...	...	94 28	92 33	90 37	88 42	86 47	48
52	...	...	...	...	...	...	...	...	...	106 21	104 06	101 51	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.91	2.84	2.77	2.70	2.64	2.58	2.52	2.46	2.41	2.36	2.31	2.26	$\triangle_1 h$
Log.	0.463 89	0.453 32	0.442 48	0.431 36	0.421 60	0.411 62	0.401 40	0.390 94	0.382 02	0.372 91	0.363 61	0.354 11	Log.
Limit	37	37	38	39	39	40	40	41	42	43	43	44	Minutes
Meridian	56°	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 35	0 34	0 33	0 33	0 32	0 31	0 30	0 30	0 30	0 29	0 28	4
8	2 22	2 19	2 16	2 13	2 11	2 08	2 05	2 03	2 01	1 59	1 56	1 54	8
12	5 18	5 12	5 06	5 00	4 54	4 48	4 43	4 38	4 32	4 28	4 22	4 17	12
16	9 26	9 16	9 06	8 52	8 42	8 32	8 21	8 14	8 04	7 56	7 46	7 35	16
20	14 44	14 28	14 12	13 52	13 36	13 20	13 04	12 52	12 36	12 24	12 08	11 52	20
24	21 13	20 50	20 27	19 58	19 35	19 12	18 49	18 31	18 09	17 52	17 29	17 05	24
28	28 53	28 21	27 50	27 11	26 39	26 08	25 37	25 14	24 42	24 18	23 47	23 16	28
32	37 43	37 02	36 21	35 30	34 49	34 08	33 27	32 57	32 15	31 44	31 03	30 23	32
36	47 44	46 53	46 01	44 56	44 04	43 12	42 20	41 41	40 50	40 11	39 19	38 27	36
40	58 56	57 52	56 48	55 28	54 24	53 20	52 16	51 28	50 24	49 36	48 32	47 28	40
44	71 18	70 02	68 44	67 07	65 49	64 32	63 14	62 16	60 59	60 01	58 44	57 26	44
48	84 52	83 19	81 46	79 52	78 20	76 48	75 16	74 07	72 34	71 25	69 53	68 19	48
52	99 36	97 47	95 59	93 44	91 56	90 08	88 20	86 59	85 10	83 49	82 01	80 13	52
56	...	...	...	...	...	104 32	102 26	100 52	98 47	97 13	95 08	93 02	56
60	...	...	...	...	...	...	...	...	113 24	111 36	109 12	106 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.21	2.17	2.13	2.08	2.04	2.00	1.96	1.93	1.89	1.86	1.82	1.78	$\triangle_1 h$
Log.	0.344 39	0.336 46	0.328 38	0.318 06	0.309 63	0.301 03	0.292 26	0.285 56	0.276 46	0.269 51	0.260 07	0.250 42	Log.
Limit	45	46	47	47	47	48	49	50	51	51	52	53	Minutes
Meridian	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	Altitudes

Latitude 34° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 27	0 27	0 27	0 26	0 26	0 25	0 25	0 24	0 23	0 23	0 22	4
8	1 52	1 50	1 47	1 45	1 44	1 42	1 41	1 39	1 36	1 35	1 34	1 32	8
12	4 12	4 06	4 02	3 57	3 54	3 50	3 46	3 42	3 37	3 34	3 31	3 24	12
16	7 28	7 18	7 10	7 03	6 58	6 50	6 42	6 34	6 27	6 18	6 13	6 06	16
20	11 40	11 24	11 12	11 00	10 52	10 40	10 28	10 16	10 04	9 52	9 44	9 32	20
24	16 48	16 25	16 08	15 51	15 39	15 22	15 04	14 47	14 30	14 12	14 01	13 43	24
28	22 52	22 21	21 57	21 33	21 18	20 54	20 31	20 07	19 44	19 21	19 05	18 42	28
32	29 52	29 11	28 40	28 09	27 49	27 18	26 48	26 17	25 46	25 16	24 55	24 25	32
36	37 48	36 56	36 18	35 39	35 13	34 34	33 55	33 16	32 37	31 58	31 32	30 53	36
40	46 40	45 36	44 48	44 00	43 28	42 40	41 52	41 04	40 16	39 28	38 56	38 08	40
44	56 28	55 10	54 13	53 15	52 36	51 38	50 40	49 41	48 43	47 45	47 06	46 08	44
48	67 10	65 38	64 30	63 21	62 35	61 26	60 17	59 08	57 59	56 50	56 04	54 55	48
52	78 52	77 04	75 42	74 21	73 27	72 06	70 45	69 24	68 03	66 42	65 48	64 27	52
56	91 28	89 22	87 49	86 15	85 12	83 38	82 04	80 29	78 55	77 21	76 18	74 44	56
60	105 00	102 36	100 48	99 00	97 48	96 00	94 12	92 24	90 36	88 48	87 36	85 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.75	1.71	1.68	1.65	1.63	1.60	1.57	1.54	1.51	1.48	1.46	1.43	$\triangle_1 h$
Log.	0.243 04	0.233 00	0.225 31	0.217 48	0.212 19	0.204 12	0.195 90	0.187 52	0.178 98	0.170 26	0.164 35	0.155 34	Log.
Limit	54	55	55	56	57	58	59	59	60	61	62	63	Minutes
Meridian	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 21	0 21	0 20	0 20	0 19	0 19	0 19	0 19	0 16	4
8	1 30	1 28	1 26	1 25	1 23	1 21	1 20	1 18	1 17	1 15	1 13	1 12	8
12	3 22	3 19	3 14	3 11	3 07	3 03	3 00	2 56	2 53	2 50	2 45	2 42	12
16	5 58	5 53	5 46	5 41	5 33	5 25	5 20	5 12	5 07	5 02	4 55	4 50	16
20	9 20	9 12	9 00	8 52	8 40	8 28	8 20	8 08	8 00	7 52	7 40	7 32	20
24	13 26	13 15	12 58	12 46	12 29	12 11	12 00	11 43	11 31	11 20	11 03	10 51	24
28	18 18	18 02	17 38	17 23	16 59	16 36	16 20	15 57	15 41	15 25	15 01	14 46	28
32	23 54	23 33	23 02	22 42	22 11	21 41	21 20	20 49	20 29	20 08	19 37	19 17	32
36	30 14	29 49	29 10	28 44	28 05	27 26	27 00	26 21	25 55	25 30	24 51	24 25	36
40	37 20	36 48	36 00	35 28	34 40	33 52	33 20	32 32	32 00	31 28	30 40	30 08	40
44	45 10	44 32	43 34	42 55	41 57	40 59	40 20	39 22	38 43	38 05	37 07	36 28	44
48	53 46	52 59	51 50	51 04	49 55	48 46	48 00	46 51	46 05	45 18	44 09	43 23	48
52	63 06	62 11	60 50	59 56	58 35	57 14	56 20	54 59	54 05	53 10	51 49	50 55	52
56	73 10	72 08	70 34	69 31	67 57	66 23	65 20	63 46	62 43	61 41	60 07	59 04	56
60	84 00	82 48	81 00	79 48	78 00	76 12	75 00	73 12	72 00	70 48	69 00	67 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.40	1.38	1.35	1.33	1.30	1.27	1.25	1.22	1.20	1.18	1.15	1.13	$\triangle_1 h$
Log.	0.146 13	0.139 88	0.130 33	0.123 85	0.113 94	0.103 80	0.096 91	0.086 36	0.079 18	0.071 88	0.060 70	0.053 08	Log.
Limit	64	65	66	67	69	70	71	72	73	73	74	75	Minutes
Meridian	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	Altitudes

Latitude 34° Declination Contrary Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 17	0 17	0 16	...	...	...	...	...	...	...	...	4
8	1 10	1 09	1 08	1 06	...	...	...	...	...	...	...	...	8
12	2 38	2 36	2 33	2 28	...	...	...	...	...	...	...	...	12
16	4 42	4 36	4 31	4 24	...	...	...	...	...	...	...	...	16
20	7 20	7 12	7 04	6 52	...	...	...	...	...	...	...	...	20
24	10 34	10 22	10 11	9 53	...	...	...	...	...	...	...	...	24
28	14 22	14 07	13 51	13 28	...	...	...	...	...	...	...	...	28
32	18 46	18 26	18 05	17 35	...	...	...	...	...	...	...	...	32
36	23 46	23 20	22 54	22 15	...	...	...	...	...	...	...	...	36
40	29 20	28 48	28 16	27 28	...	...	...	...	...	...	...	...	40
44	35 30	34 51	34 12	33 14	...	...	...	...	...	...	...	...	44
48	42 14	41 28	40 42	39 33	...	...	...	...	...	...	...	...	48
52	49 34	48 40	47 46	46 25	...	...	...	...	...	...	...	...	52
56	57 30	56 27	55 24	53 50	...	...	...	...	...	...	...	...	56
60	66 00	64 48	63 36	61 48	...	...	...	...	...	...	...	..	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.10	1.08	1.06	1.03	...	...	...	...	...	...	...	...	$\Delta_1 h$
Log.	0.041 39	0.033 42	0.025 31	0.012 84	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	75	75	76	76									Minutes
Meridian	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 13	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	4
8	0 52	0 51	0 49	0 47	0 46	0 44	0 42	0 41	0 39	0 38	0 37	0 35	8
12	1 56	1 54	1 50	1 47	1 44	1 39	1 36	1 33	1 29	1 26	1 22	1 18	12
16	3 28	3 22	3 14	3 09	3 04	2 57	2 52	2 47	2 39	2 34	2 26	2 18	16
20	5 24	5 16	5 04	4 56	4 48	4 36	4 28	4 20	4 08	4 00	3 48	3 36	20
24	7 47	7 35	7 18	7 06	6 55	6 38	6 26	6 15	5 58	5 46	5 28	5 11	24
28	10 35	10 20	9 56	9 40	9 25	9 01	8 45	8 29	8 06	7 50	7 27	7 03	28
32	13 49	13 29	12 58	12 38	12 17	11 46	11 26	11 05	10 34	10 14	9 44	9 13	32
36	17 30	17 04	16 25	15 59	15 33	14 55	14 29	14 03	13 24	12 58	12 18	11 40	36
40	21 36	21 04	20 16	19 44	19 12	18 24	17 52	17 20	16 32	16 00	15 12	14 24	40
44	26 08	25 29	24 31	23 52	23 14	22 16	21 38	20 59	20 01	19 22	18 24	17 25	44
48	31 06	30 18	29 09	28 23	27 37	26 29	25 43	24 57	23 48	23 02	21 54	20 44	48
52	36 30	35 36	34 15	33 21	32 27	31 05	30 11	29 17	27 56	27 02	25 41	24 20	52
56	42 20	41 17	39 43	38 40	37 38	36 04	35 02	33 59	32 25	31 22	29 48	28 13	56
60	48 36	47 24	45 36	44 24	43 12	41 24	40 12	39 00	37 12	36 00	31 12	32 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.81	0.79	0.76	0.74	0.72	0.69	0.67	0.65	0.62	0.60	0.57	0.54	$\Delta_1 h$
Log.	9.908 49	9.897 63	9.880 81	9.869 23	9.857 33	9.838 85	9.826 07	9.812 91	9.792 39	9.778 15	9.755 87	9.732 39	Log.
Limit	84	84	84	85	85	86	86	87	87	88	89	90	Minutes
Meridian	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	Altitudes

Latitude 35° Declination Same Name.

Declinations.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 45	0 46	0 47	0 48	0 50	0 51	0 53	0 54	0 56	0 58	1 00	1 02	4
8	2 59	3 04	3 09	3 14	3 19	3 25	3 31	3 38	3 45	3 51	4 00	4 08	8
12	6 43	6 55	7 05	7 16	7 29	7 41	7 55	8 10	8 25	8 41	9 00	9 19	12
16	11 57	12 17	12 35	12 56	13 19	13 39	14 05	14 30	14 59	15 27	16 00	16 33	16
20	18 40	19 12	19 40	20 12	20 48	21 20	22 00	22 40	23 24	24 08	25 00	25 52	20
24	26 53	27 39	28 19	29 05	29 58	30 43	31 41	32 38	33 42	34 46	36 00	37 15	24
28	36 35	37 38	38 33	39 36	40 46	41 49	43 07	44 26	45 52	47 18	49 00	50 42	28
32	47 47	49 09	50 21	51 43	53 14	54 37	56 19	58 02	59 54	61 46	64 00	66 13	32
36	60 29	62 13	63 43	65 27	67 24	69 07	71 17	73 26	75 49	78 12	...	...	36
40	74 40	76 48	78 40	80 48	83 12	85 20	88 00	90 40	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.80	2.88	2.95	3.03	3.12	3.20	3.30	3.40	3.51	3.62	3.75	3.88	$\triangle_1$h
Log.	0.447 16	0.459 39	0.469 82	0.481 44	0.494 15	0.505 15	0.518 51	0.531 48	0.545 31	0.558 71	0.574 03	0.588 83	Log.
Limit	38	37	36	35	34	34	33	33	32	32	31	30	Minutes
Meridian	55°	56°	57°	58°	59°	60°	61°	62°	63°	64°	65°	66°	Altitudes

Declinations.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 04	1 07	1 10	1 13	1 16	1 19	1 23	1 28	1 34	1 39	1 46	1 54	4
8	4 18	4 27	4 38	4 51	5 04	5 18	5 35	5 53	6 14	6 38	7 04	7 35	8
12	9 40	10 02	10 26	10 54	11 24	11 58	12 33	13 15	14 01	14 54	15 54	17 05	12
16	17 12	17 50	18 34	19 22	20 16	21 14	22 19	23 33	24 55	26 30	28 18	30 23	16
20	26 52	27 52	29 00	30 16	31 40	33 12	34 52	36 48	38 56	41 24	44 12	47 28	20
24	38 41	40 08	41 46	43 35	45 36	47 48	50 12	53 00	56 04	59 37	63 39	...	24
28	52 40	54 37	56 50	59 19	62 02	65 03	68 21	72 08	76 18	81 09	...	...	28
32	68 47	71 20	74 14	77 29	81 04	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	4.03	4.18	4.35	4.54	4.75	4.98	5.23	5.52	5.84	6.21	6.63	7.12	$\triangle_1$h
Log.	0.605 31	0.621 18	0.638 49	0.657 06	0.676 69	0.697 23	0.718 50	0.741 94	0.766 41	0.793 09	0.821 51	0.852 48	Log.
Limit	29	28	27	27	26	25	24	23	22	21	20	19	Minutes
Meridian	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 03	2 14	2 28	2 45	3 07	3 35	4 16	...	...	...	...	...	4
8	8 13	8 57	9 52	10 59	12 25	14 21	17 02	...	...	...	...	...	8
12	18 29	20 08	22 11	24 43	27 57	32 17	38 22	...	...	...	...	...	12
16	32 51	35 48	39 25	43 57	49 43	...	...	...	...	...	...	...	16
20	51 20	55 56	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	7.70	8.39	9.24	10.30	11.65	13.45	15.98	...	...	...	...	...	$\Delta_1 h$
Log.	0.886 49	0.923 76	0.965 67	1.012 84	1.066 33	1.128 72	1.203 51	... ...	... ...	... ...	... ...	... ...	Log.
Limit	17	16	15	14	13	11	9	8	6	4	2	0	Minutes
Meridian	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	3 47	3 06	2 37	2 15	1 58	1 45	1 34	1 24	4
8	...	...	...	...	15 05	12 23	10 28	9 01	7 54	6 59	6 15	5 38	8
12	...	...	...	...	33 56	27 51	23 32	20 17	17 46	15 43	14 04	12 41	12
16	...	...	...	...	...	...	41 52	36 03	31 34	27 57	25 00	22 31	16
20	...	...	...	...	...	...	...	56 20	49 20	43 40	39 04	35 12	20
24	...	...	...	...	...	...	...	...	...	...	56 16	50 41	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	...	14.14	11.61	9.81	8.45	7.40	6.55	5.86	5.28	$\Delta_1 h$
Log.	... ...	... ...	... ...	... ...	1.150 45	1.064 83	0.991 67	0.926 86	0.869 23	0.816 24	0.767 90	0.722 63	Log.
Limit	2	4	6	8	9	11	13	15	17	18	20	22	Minutes
Meridian	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	Altitudes

Latitude 35° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 16	1 10	1 03	0 59	0 54	0 50	0 46	0 43	0 40	0 38	0 35	0 33	4
8	5 06	4 39	4 15	3 55	3 37	3 20	3 05	2 53	2 41	2 30	2 19	2 11	8
12	11 29	10 28	9 35	8 48	8 08	7 30	6 58	6 29	6 01	5 37	5 14	4 54	12
16	20 23	18 36	17 01	15 40	14 28	13 22	12 22	11 31	10 43	9 59	9 18	8 42	16
20	31 52	29 04	26 36	24 48	22 36	20 52	19 20	18 00	16 44	15 36	14 32	13 36	20
24	45 53	41 52	38 18	35 14	32 33	30 03	27 50	25 55	24 06	22 28	20 56	19 35	24
28	62 26	56 58	52 09	47 57	44 18	40 54	37 54	35 17	32 48	30 34	28 29	26 39	28
32	...	...	68 06	62 38	57 51	53 25	49 30	46 05	42 50	39 56	37 12	34 49	32
36	...	...	...	...	73 14	67 37	62 38	58 19	54 13	50 33	47 06	44 04	36
40	...	...	...	...	...	...	...	72 00	66 56	62 24	58 08	54 24	40
44	...	...	...	...	...	...	...	...	...	75 30	70 21	65 49	44
48	...	...	...	...	...	...	...	...	...	...	...	78 20	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.78	4.36	3.99	3.67	3.39	3.13	2.90	2.70	2.51	2.34	2.18	2.04	$\triangle_1 h$
Log.	0.679 43	0.639 49	0.600 97	0.564 67	0.530 20	0.495 54	0.462 40	0.431 36	0.399 67	0.369 22	0.338 46	0.309 63	Log.
Limit	24	25	26	28	29	30	31	32	34	36	38	40	Minutes
Meridian	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 28	0 27	0 25	0 23	0 22	0 20	0 19	0 18	0 16	0 15	0 14	4
8	2 01	1 54	1 46	1 40	1 33	1 26	1 21	1 15	1 11	1 06	1 01	0 57	8
12	4 34	4 17	3 59	3 45	3 29	3 14	3 03	2 50	2 39	2 28	2 19	2 08	12
16	8 06	7 35	7 05	6 39	6 11	5 46	5 25	5 02	4 45	4 24	4 05	3 48	16
20	12 40	11 52	11 04	10 24	9 40	9 00	8 28	7 52	7 24	6 52	6 24	5 56	20
24	18 14	17 05	15 57	14 59	13 55	12 58	12 11	11 20	10 40	9 53	9 13	8 33	24
28	24 50	23 16	21 41	20 23	18 57	17 38	16 36	15 25	14 30	13 28	12 33	11 38	28
32	32 26	30 23	28 19	26 37	24 45	23 02	21 41	20 08	18 56	17 35	16 23	15 11	32
36	41 02	38 27	35 52	33 42	31 19	29 10	27 26	25 30	23 59	22 15	20 44	19 14	36
40	50 40	47 28	44 16	41 36	38 40	36 00	33 52	31 28	29 36	27 28	25 36	23 44	40
44	61 18	57 26	53 34	50 20	46 47	43 34	40 59	38 05	35 49	33 14	30 58	28 43	44
48	72 58	68 19	63 44	59 54	55 41	51 50	48 46	45 18	42 37	39 33	36 52	34 10	48
52	85 38	80 13	74 48	70 18	65 21	60 50	57 14	53 10	50 01	46 25	43 16	40 06	52
56	...	...	...	81 32	75 37	70 34	66 23	61 41	58 01	53 50	50 10	46 31	56
60	...	...	...	...	87 00	81 00	76 12	70 48	66 36	61 48	57 36	53 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.90	1.78	1.66	1.56	1.45	1.35	1.27	1.18	1.11	1.03	0.96	0.89	$\triangle_1 h$
Log.	0.278 75	0.250 42	0.220 11	0.193 12	0.161 37	0.130 33	0.103 80	0.071 88	0.045 32	0.012 84	9.982 27	9.949 39	Log.
Limit	43	44	46	48	50	51	53	55	57	59	61	63	Minutes
Meridian	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	54°	Altitudes

Latitude 35° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 45	0 44	0 43	0 42	0 41	0 39	0 39	0 38	0 38	0 36	0 36	0 35	4
8	2 59	2 56	2 51	2 47	2 43	2 40	2 37	2 33	2 30	2 27	2 24	2 20	8
12	6 43	6 35	6 24	6 15	6 07	5 59	5 52	5 44	5 37	5 30	5 23	5 15	12
16	11 57	11 41	11 24	11 09	10 53	10 37	10 24	10 12	9 59	9 46	9 33	9 21	16
20	18 40	18 16	17 48	17 24	17 00	16 36	16 16	15 56	15 36	15 16	14 56	14 36	20
24	26 53	26 18	25 38	25 04	24 29	23 54	23 25	22 57	22 28	21 59	21 30	21 02	24
28	36 35	35 48	34 53	34 06	33 19	32 33	31 53	31 14	30 34	29 56	29 16	28 37	28
32	47 47	46 46	45 34	44 32	43 31	42 30	41 39	40 47	39 56	39 05	38 14	37 22	32
36	60 29	59 11	57 41	56 23	55 05	53 47	52 42	51 38	50 33	49 28	48 23	47 19	36
40	74 40	73 04	71 12	69 36	68 00	66 24	65 04	63 44	62 24	61 04	59 44	58 24	40
44	...	88 24	86 10	84 13	82 17	80 20	78 43	77 07	75 30	73 53	72 16	70 40	44
48	...	...	...	...	...	95 37	93 42	91 46	89 51	87 56	86 01	84 05	48
52	...	...	...	...	...	...	...	107 42	105 27	103 12	100 57	98 41	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.80	2.74	2.67	2.61	2.55	2.49	2.44	2.39	2.34	2.29	2.24	2.19	$\triangle_1 h$
Log.	0.447 16	0.437 75	0.426 51	0.416 64	0.406 54	0.396 20	0.387 39	0.378 40	0.369 22	0.359 84	0.350 25	0.340 44	Log.
Limit	38	38	39	40	41	41	41	42	42	43	44	45	Minutes
Meridian	55°	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 34	0 33	0 32	0 31	0 31	0 30	0 30	0 30	0 29	0 28	0 28	4
8	2 17	2 15	2 13	2 10	2 07	2 04	2 02	2 00	1 58	1 56	1 54	1 52	8
12	5 09	5 03	4 58	4 52	4 47	4 41	4 37	4 31	4 26	4 20	4 17	4 12	12
16	9 11	9 01	8 50	8 40	8 29	8 19	8 11	8 01	7 54	7 44	7 35	7 28	16
20	14 20	14 04	13 48	13 32	13 16	13 00	12 48	12 32	12 20	12 04	11 52	11 40	20
24	20 39	20 16	19 52	19 29	19 06	18 43	18 26	18 03	17 46	17 23	17 05	16 48	24
28	28 05	27 34	27 03	26 32	26 01	25 29	25 06	24 34	24 10	23 39	23 16	22 52	28
32	36 41	36 00	35 20	34 39	33 58	33 17	32 46	32 05	31 34	30 53	30 23	29 52	32
36	46 27	45 35	44 43	43 51	42 59	42 07	41 28	40 37	39 58	39 06	38 27	37 48	36
40	57 20	56 16	55 12	54 08	53 04	52 00	51 12	50 08	49 20	48 16	47 28	46 40	40
44	69 23	68 05	66 48	65 30	64 12	62 55	61 57	60 40	59 42	58 24	57 26	56 28	44
48	82 33	81 01	79 29	77 57	76 25	74 53	73 44	72 11	71 02	69 30	68 19	67 10	48
52	96 53	95 05	93 17	91 29	89 41	87 53	86 32	84 43	83 22	81 34	80 13	78 52	52
56	...	...	...	...	104 01	101 55	100 21	98 15	96 42	94 36	93 02	91 28	56
60	...	...	...	...	...	...	...	112 48	111 00	108 36	106 48	105 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.15	2.11	2.07	2.03	1.99	1.95	1.92	1.88	1.85	1.81	1.78	1.75	$\triangle_1 h$
Log.	0.332 44	0.324 28	0.315 97	0.307 50	0.298 85	0.290 03	0.283 30	0.274 16	0.267 17	0.257 68	0.250 42	0.243 04	Log.
Limit	46	46	47	48	48	49	50	51	52	52	53	54	Minutes
Meridian	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	Altitudes

Latitude 35° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 27	0 26	0 25	0 25	0 25	0 24	0 23	0 23	0 22	0 22	4
8	1 50	1 47	1 45	1 43	1 42	1 41	1 39	1 36	1 35	1 33	1 32	1 30	8
12	4 06	4 00	3 57	3 53	3 49	3 46	3 42	3 37	3 34	3 29	3 24	3 22	12
16	7 18	7 08	7 03	6 55	6 47	6 42	6 34	6 27	6 18	6 11	6 06	5 58	16
20	11 24	11 08	11 00	10 48	10 36	10 28	10 16	10 04	9 52	9 40	9 32	9 20	20
24	16 25	16 02	15 51	15 34	15 16	15 04	14 47	14 30	14 12	13 55	13 43	13 26	24
28	22 21	21 49	21 33	21 10	20 47	20 31	20 07	19 44	19 21	18 57	18 42	18 18	28
32	29 11	28 30	28 09	27 38	27 08	26 48	26 17	25 46	25 16	24 45	24 25	23 54	32
36	36 56	36 05	35 39	35 00	34 21	33 55	33 16	32 37	31 58	31 19	30 53	30 14	36
40	45 36	44 32	44 00	43 12	42 24	41 52	41 04	40 16	39 28	38 40	38 08	37 20	40
44	55 10	53 54	53 15	52 17	51 18	50 40	49 41	48 43	47 45	46 47	46 08	45 10	44
48	65 38	64 07	63 21	62 12	61 03	60 17	59 08	57 59	56 50	55 41	54 55	53 46	48
52	77 04	75 15	74 21	73 00	71 39	70 35	69 24	68 03	66 42	65 21	64 27	63 06	52
56	89 22	87 18	86 15	84 41	83 06	82 04	80 29	78 55	77 21	75 47	74 44	73 10	56
60	102 36	100 12	99 00	97 12	95 24	94 12	92 24	90 36	88 48	87 00	85 48	84 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△$_1$h	1.71	1.67	1.65	1.62	1.59	1.57	1.54	1.51	1.48	1.45	1.43	1.40	△$_1$h
Log.	0.233 00	0.222 72	0.217 48	0.209 52	0.201 40	0.195 90	0.187 52	0.178 98	0.170 26	0.161 37	0.155 34	0.146 13	Log.
Limit	55	56	56	57	58	59	60	60	61	62	63	64	Minutes
Meridian	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 21	0 21	0 20	0 20	0 19	0 19	0 19	0 19	0 19	0 18	4
8	1 28	1 26	1 25	1 23	1 21	1 20	1 19	1 17	1 15	1 14	1 13	1 11	8
12	3 19	3 14	3 11	3 07	3 03	3 00	2 57	2 53	2 50	2 47	2 44	2 39	12
16	5 53	5 46	5 41	5 33	5 25	5 20	5 15	5 07	5 02	4 57	4 52	4 45	16
20	9 12	9 00	8 52	8 40	8 28	8 20	8 12	8 00	7 52	7 44	7 36	7 24	20
24	13 15	12 58	12 46	12 29	12 11	12 00	11 48	11 31	11 20	11 09	10 57	10 40	24
28	18 02	17 38	17 23	16 59	16 36	16 20	16 05	15 41	15 25	15 09	14 53	14 30	28
32	23 33	23 02	22 42	22 11	21 41	21 20	21 00	20 29	20 08	19 47	19 27	18 56	32
36	29 49	29 10	28 44	28 05	27 26	27 00	26 34	25 55	25 30	25 04	24 38	23 59	36
40	36 48	36 00	35 28	34 40	33 52	33 20	32 48	32 00	31 28	30 56	30 24	29 36	40
44	44 32	43 34	42 55	41 57	40 59	40 20	39 41	38 43	38 05	37 26	36 47	35 49	44
48	52 59	51 50	51 04	49 55	48 45	48 00	47 14	46 05	45 18	44 32	43 46	42 37	48
52	62 11	60 50	59 56	58 35	57 14	56 20	55 26	54 05	53 10	52 16	51 22	50 01	52
56	72 08	70 34	69 31	67 57	66 23	65 20	64 17	62 43	61 41	60 38	59 35	58 01	56
60	82 48	81 00	79 48	78 00	76 12	75 00	73 48	72 00	70 48	69 36	68 24	66 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△$_1$h	1.38	1.35	1.33	1.30	1.27	1.25	1.23	1.20	1.18	1.16	1.14	1.11	△$_1$h
Log.	0.139 88	0.130 33	0.123 85	0.113 94	0.103 80	0.096 91	0.089 91	0.079 18	0.071 88	0.064 46	0.056 90	0.045 32	Log.
Limit	65	66	67	68	69	70	71	72	73	74	75	75	Minutes
Meridian	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 17	...	...	...	...	...	...	...	...	...	4
8	1 10	1 08	1 07	...	...	...	...	...	...	...	...	...	8
12	2 37	2 34	2 30	...	...	...	...	...	...	...	...	...	12
16	4 39	4 34	4 26	...	...	...	...	...	...	...	...	...	16
20	7 16	7 08	6 56	...	...	...	...	...	...	...	...	...	20
24	10 28	10 16	9 59	...	...	...	...	...	...	...	...	...	24
28	14 15	13 59	13 35	...	...	...	...	...	...	...	...	...	28
32	18 36	18 16	17 45	...	...	...	...	...	...	...	...	...	32
36	23 33	23 07	22 28	...	...	...	...	...	...	...	...	...	36
40	29 04	28 32	27 44	...	...	...	...	...	...	...	...	...	40
44	35 10	34 32	33 33	...	...	...	...	...	...	...	...	...	44
48	41 51	41 05	39 56	...	...	...	...	...	...	...	...	...	48
52	49 07	48 13	46 52	...	...	...	...	...	...	...	...	...	52
56	56 58	55 56	54 21	...	...	...	...	...	...	...	...	...	56
60	65 24	64 12	62 24	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.09	1.07	1.04	...	...	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.037 43	0.029 38	0.017 03	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	75	76	76										Minutes
Meridian	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 13	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 10	0 09	0 09	0 09	4
8	0 51	0 50	0 48	0 47	0 45	0 44	0 42	0 40	0 39	0 38	0 37	0 35	8
12	1 55	1 52	1 48	1 47	1 42	1 39	1 36	1 32	1 27	1 25	1 22	1 19	12
16	3 25	3 19	3 12	3 09	3 02	2 57	2 52	2 44	2 37	2 31	2 26	2 21	16
20	5 20	5 12	5 00	4 56	4 44	4 36	4 28	4 16	4 04	3 56	3 48	3 40	20
24	7 41	7 29	7 12	7 06	6 49	6 38	6 26	6 09	5 52	5 40	5 28	5 17	24
28	10 27	10 12	9 48	9 40	9 17	9 01	8 45	8 21	7 58	7 43	7 27	7 11	28
32	13 39	13 19	12 48	12 38	12 07	11 46	11 26	10 55	10 24	10 04	9 44	9 23	32
36	17 17	16 51	16 12	15 59	15 20	14 55	14 29	13 50	13 11	12 45	12 18	11 53	36
40	21 20	20 48	20 00	19 44	18 56	18 24	17 52	17 04	16 16	15 44	15 12	14 40	40
44	25 49	25 10	24 12	23 52	22 54	22 16	21 38	20 39	19 41	19 02	18 24	17 45	44
48	30 43	29 55	28 46	28 23	27 14	26 29	25 43	24 34	23 25	22 39	21 54	21 07	48
52	36 03	35 09	33 48	33 21	32 00	31 05	30 11	28 50	27 29	26 35	25 41	24 47	52
56	41 49	40 46	39 12	38 40	37 06	36 04	35 02	33 27	31 53	30 50	29 48	28 45	56
60	48 00	46 48	45 00	44 24	42 36	41 24	40 12	38 24	36 36	35 24	34 12	33 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.80	0.78	0.75	0.73	0.71	0.69	0.67	0.64	0.61	0.59	0.57	0.55	$\triangle_1 h$
Log.	9.903 09	9.892 09	9.875 06	9.863 32	9.851 26	9.838 85	9.826 07	9.806 18	9.785 33	9.770 85	9.755 87	9.740 36	Log.
Limit	83	83	84	84	85	86	87	87	88	88	88	90	Minutes
Meridian	5°	6°	7°	8°	9°	10 °	11°	12°	13°	14°	15°	16°	Altitudes

Latitude 36° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 44	0 46	0 46	0 47	0 49	0 51	0 52	0 54	0 55	0 57	0 59	4
8	2 53	2 58	3 02	3 06	3 11	3 17	3 22	3 28	3 34	3 42	3 49	3 56	8
12	6 29	6 39	6 49	6 59	7 11	7 22	7 35	7 48	8 02	8 19	8 34	8 51	12
16	11 31	11 49	12 07	12 25	12 45	13 06	13 29	13 52	14 18	14 45	15 14	15 45	16
20	18 00	18 28	18 56	19 24	19 56	20 28	21 04	21 40	22 20	23 04	23 48	24 36	20
24	25 55	26 35	27 16	27 56	28 42	29 28	30 21	31 12	32 10	33 13	34 16	35 26	24
28	35 17	36 12	37 06	38 02	39 05	40 07	41 17	42 28	43 46	45 13	46 39	48 13	28
32	46 05	47 17	48 28	49 40	51 02	52 24	53 55	55 28	57 10	59 03	60 56	62 58	32
36	58 19	59 50	61 21	62 51	64 35	66 19	68 16	70 12	72 22	74 44	77 07	79 43	36
40	72 00	73 52	75 44	77 36	79 44	81 52	84 16	86 40	89 20	92 16	...	...	40
44	87 07	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.70	2.77	2.84	2.91	2.99	3.07	3.16	3.25	3.35	3.46	3.57	3.69	$\triangle_1 h$
Log.	0.431 36	0.442 48	0.453 32	0.463 89	0.475 67	0.487 14	0.499 69	0.511 88	0.525 04	0.539 08	0.552 67	0.567 03	Log.
Limit	38	38	37	36	35	35	35	34	33	33	32	31	Minutes
Meridian	54°	55°	56°	57°	58°	59°	60°	61°	62°	63°	64°	65°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 01	1 03	1 06	1 08	1 11	1 15	1 18	1 23	1 26	1 31	1 37	1 44	4
8	4 05	4 13	4 23	4 34	4 46	4 59	5 13	5 29	5 47	6 07	6 30	6 56	8
12	9 10	9 31	9 51	10 17	10 43	11 12	11 44	12 20	13 01	13 45	14 37	15 36	12
16	16 18	16 53	17 33	18 15	19 01	19 56	20 52	21 56	23 07	24 27	25 59	27 44	16
20	25 28	26 24	27 24	28 32	29 44	31 08	32 36	34 16	36 08	38 12	40 36	43 20	20
24	36 41	38 01	39 28	41 05	42 48	44 50	46 57	49 21	52 02	55 00	58 28	62 24	24
28	49 55	51 45	53 42	55 56	57 17	61 01	63 54	67 09	70 50	74 53	79 35	...	28
32	65 11	67 35	70 08	73 03	76 07	79 42	83 27	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.82	3.96	4.11	4.28	4.46	4.67	4.89	5.14	5.42	5.73	6.09	6.50	$\triangle_1 h$
Log.	0.582 06	0.597 70	0.613 84	0.631 44	0.649 33	0.669 32	0.689 31	0.710 96	0.734 00	0.758 15	0.784 62	0.812 91	Log.
Limit	30	29	28	28	27	26	25	24	23	22	21	20	Minutes
Meridian	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 51	2 01	2 11	2 25	2 41	3 02	3 31	4 10	...	...	...	...	4
8	7 26	8 03	8 46	9 39	10 45	12 10	14 02	16 39	...	...	...	...	8
12	16 46	18 06	19 44	21 43	24 12	27 22	31 35	37 39	...	...	...	...	12
16	29 46	32 10	35 04	38 37	43 00	...	...	...	...	...	...	...	16
20	46 32	50 16	54 48	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.98	7.54	8.22	9.05	10.08	11.40	13.16	15.62	...	...	...	...	$\triangle_1 h$
Log.	0.843 86	0.877 37	0.914 87	0.956 65	1.003 46	1.056 90	1.119 26	1.193 68	... ...	... ...	... ...	... ...	Log.
Limit	19	17	16	15	14	12	11	9	8	6	4	2	Minutes
Meridian	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	3 40	3 00	2 32	2 11	1 55	1 42	1 31	4
8	...	...	...	...	...	14 40	12 03	10 10	8 46	7 39	6 47	6 03	8
12	...	...	...	...	...	33 00	27 06	22 52	19 42	17 14	15 16	13 38	12
16	...	...	...	...	...	...	...	40 40	35 02	30 38	27 08	24 14	16
20	...	...	...	...	...	...	...	...	54 44	47 52	42 24	37 52	20
24	...	...	...	...	...	...	...	...	...	...	61 04	54 32	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	13.75	11.29	9.53	8.21	7.18	6.36	5.68	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	1.138 30	1.052 69	0.979 09	0.914 34	0.856 12	0.803 46	0.754 35	Log.
Limit	0	2	4	6	8	10	12	14	16	17	19	21	Minutes
Meridian	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	Altitudes

Latitude 36° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 22	1 14	1 07	1 02	0 57	0 52	0 48	0 44	0 42	0 38	0 36	0 33	4
8	5 27	4 56	4 30	4 07	3 47	3 30	3 13	2 59	2 46	2 35	2 24	2 14	8
12	12 15	11 06	10 08	9 16	8 31	7 53	7 15	6 42	6 14	5 47	5 24	5 01	12
16	21 49	19 46	18 00	16 28	15 09	13 59	12 53	11 54	11 06	10 17	9 36	8 55	16
20	34 04	30 52	28 08	25 44	23 40	21 52	20 08	18 36	17 20	16 04	15 00	13 56	20
24	49 04	44 27	40 31	37 04	34 05	31 29	29 00	26 47	24 58	23 08	21 36	20 04	24
28	66 46	60 30	55 09	50 26	46 23	42 52	39 28	36 28	33 58	31 30	29 24	27 19	28
32	...	...	...	...	60 35	55 59	51 32	47 37	44 22	41 08	38 24	35 40	32
36	...	...	...	...	...	70 51	65 14	60 16	56 10	52 03	48 36	45 09	36
40	...	...	...	...	...	...	80 32	74 24	69 20	64 16	60 00	55 44	40
44	...	...	...	...	...	...	...	...	83 54	77 45	72 36	67 26	44
48	...	...	...	...	...	...	...	...	...	...	...	80 15	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	5.11	4.63	4.22	3.86	3.55	3.28	3.02	2.79	2.60	2.41	2.25	2.09	$\triangle_1$h
Log.	0.708 42	0.665 58	0.625 31	0.586 59	0.550 23	0.515 87	0.480 01	0.445 60	0.414 97	0.382 02	0.352 18	0.320 15	Log.
Limit	22	24	25	27	29	31	32	33	34	36	38	40	Minutes
Meridian	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 29	0 27	0 25	0 23	0 22	0 20	0 19	0 18	0 17	0 15	0 14	4
8	2 04	1 56	1 49	1 42	1 35	1 28	1 23	1 17	1 11	1 07	1 02	0 57	8
12	4 41	4 22	4 05	3 49	3 34	3 19	3 06	2 53	2 41	2 31	2 20	2 08	12
16	8 19	7 47	7 15	6 47	6 18	5 53	5 30	5 07	4 47	4 29	4 08	3 48	16
20	13 00	12 08	11 20	10 36	9 52	9 12	8 36	8 00	7 28	7 00	6 28	5 56	20
24	18 43	17 29	16 19	15 16	14 12	13 15	12 23	11 31	10 46	10 05	9 18	8 33	24
28	25 29	23 47	22 13	20 47	19 21	18 02	16 52	15 41	14 38	13 43	12 41	11 38	28
32	33 17	31 03	29 01	27 08	25 16	23 33	22 01	20 29	19 06	17 55	16 34	15 11	32
36	42 07	39 19	36 43	34 21	31 58	29 49	27 52	25 55	24 12	22 41	20 57	19 14	36
40	52 00	48 32	45 20	42 24	39 28	36 48	34 24	32 00	29 52	28 00	25 52	23 44	40
44	62 55	58 44	54 51	51 18	47 45	44 32	41 37	38 43	36 09	33 53	31 18	28 43	44
48	74 53	69 53	65 15	61 03	56 50	52 59	49 32	46 05	43 00	40 19	37 15	34 10	48
52	87 53	82 01	76 37	71 39	66 42	62 11	58 08	54 05	50 28	47 19	43 43	40 06	52
56	...	...	...	83 06	77 21	72 08	67 25	62 43	58 33	54 53	50 42	46 31	56
60	...	...	...	...	88 48	82 48	77 24	72 00	67 12	63 00	58 12	53 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.95	1.82	1.70	1.59	1.48	1.38	1.29	1.20	1.12	1.05	0.97	0.89	$\triangle_1$h
Log.	0.290 03	0.260 07	0.230 45	0.201 40	0.170 26	0.139 88	0.110 59	0.079 18	0.049 22	0.021 19	9.986 77	9.949 39	Log.
Limit	42	43	45	47	49	50	52	54	56	58	60	62	Minutes
Meridian	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	55°	Altitudes

Latitude 36° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 43	0 41	0 40	0 39	0 38	0 38	0 37	0 36	0 35	0 35	0 34	4
8	2 53	2 49	2 45	2 41	2 39	2 35	2 31	2 28	2 25	2 22	2 19	2 16	8
12	6 29	6 20	6 12	6 03	5 56	5 47	5 40	5 32	5 26	5 20	5 12	5 06	12
16	11 31	11 16	11 00	10 45	10 32	10 17	10 04	9 52	9 38	9 28	9 16	9 06	16
20	18 00	17 36	17 12	16 48	16 28	16 04	15 44	15 24	15 04	14 48	14 28	14 12	20
24	25 55	25 21	24 46	24 12	23 42	23 08	22 40	22 11	21 42	21 19	20 50	20 27	24
28	35 17	34 29	33 43	32 56	32 17	31 30	30 50	30 11	29 32	29 01	28 21	27 50	28
32	46 05	45 03	44 02	43 00	42 10	41 08	40 16	39 25	38 34	37 53	37 02	36 21	32
36	58 19	57 02	55 44	54 26	53 21	52 03	50 59	49 54	48 49	47 57	46 53	46 01	36
40	72 00	70 24	68 48	67 12	65 52	64 16	62 56	61 36	60 16	59 12	57 22	56 48	40
44	87 07	85 11	83 15	81 19	79 42	77 45	76 09	74 32	72 55	71 38	70 02	68 44	44
48	...	...	...	...	94 51	92 33	90 37	88 42	86 47	85 15	83 19	81 46	48
52	...	...	...	...	...	...	106 21	104 06	101 51	100 03	97 47	95 59	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	2.70	2.64	2.58	2.52	2.47	2.41	2.36	2.31	2.26	2.22	2.17	2.13	Δ_1h
Log.	0.431 36	0.421 60	0.411 62	0.401 40	0.392 70	0.382 02	0.372 91	0.363 61	0.354 11	0.346 35	0.336 46	0.328 38	Log.
Limit	38	38	39	40	41	42	42	43	43	44	45	45	Minutes
Meridian	54°	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 33	0 33	0 32	0 31	0 31	0 30	0 30	0 29	0 29	0 28	0 28	0 27	4
8	2 14	2 11	2 09	2 05	2 04	2 01	2 00	1 57	1 55	1 54	1 52	1 50	8
12	5 01	4 55	4 49	4 44	4 40	4 34	4 29	4 23	4 19	4 16	4 11	4 06	12
16	8 55	8 45	8 35	8 24	8 16	8 06	7 59	7 49	7 41	7 33	7 25	7 18	16
20	13 56	13 40	13 24	13 08	12 56	12 40	12 28	12 12	12 00	11 48	11 36	11 24	20
24	20 04	19 41	19 18	18 54	18 37	18 14	17 57	17 34	17 17	16 59	16 42	16 25	24
28	27 19	26 47	26 16	25 45	25 21	24 50	24 26	23 55	23 31	23 08	22 44	22 21	28
32	35 40	34 59	34 18	33 38	33 07	32 26	31 55	31 13	30 43	30 13	29 42	29 11	32
36	45 09	44 17	43 25	42 33	41 54	41 02	40 24	39 32	38 53	38 14	37 35	36 56	36
40	55 44	54 40	53 36	52 32	51 44	50 40	49 52	48 48	48 00	47 12	46 24	45 36	40
44	67 26	66 09	64 51	63 34	62 35	61 18	60 21	59 03	58 05	57 07	56 08	55 10	44
48	80 15	78 43	77 11	75 39	74 30	72 58	71 48	70 16	69 07	67 56	66 47	65 38	48
52	94 11	92 23	90 35	88 47	87 26	85 38	84 16	82 28	81 07	79 46	78 25	77 04	52
56	...	...	105 03	102 57	101 23	99 18	97 45	95 39	94 05	92 31	90 56	89 22	56
60	...	...	...	...	...	114 00	112 12	109 48	108 36	106 12	104 24	102 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	2.09	2.05	2.01	1.97	1.94	1.90	1.87	1.83	1.80	1.77	1.74	1.71	Δ_1h
Log.	0.320 15	0.311 75	0.303 20	0.294 47	0.287 80	0.278 75	0.271 84	0.262 45	0.255 27	0.247 97	0.240 55	0.233 00	Log.
Limit	46	47	48	49	49	50	51	52	53	53	54	55	Minutes
Meridian	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	Altitudes

Latitude 36° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 26	0 25	0 25	0 24	0 24	0 23	0 23	0 22	0 22	0 22	4
8	1 47	1 45	1 42	1 41	1 40	1 38	1 36	1 35	1 33	1 32	1 30	1 28	8
12	4 02	3 56	3 51	3 48	3 45	3 40	3 37	3 34	3 29	3 24	3 22	3 19	12
16	7 10	7 00	6 53	6 44	6 39	6 32	6 27	6 18	6 11	6 06	5 58	5 53	16
20	11 12	10 56	10 44	10 32	10 24	10 11	10 04	9 52	9 40	9 32	9 20	9 12	20
24	16 08	15 45	15 28	15 10	14 59	14 41	14 30	14 12	13 55	13 43	13 26	13 15	24
28	21 57	21 25	21 02	20 39	20 23	20 00	19 44	19 21	18 57	18 42	18 18	18 02	28
32	28 40	27 59	27 28	26 58	26 37	26 07	25 46	25 16	24 45	24 25	23 54	23 33	32
36	36 18	35 26	34 47	34 08	33 42	33 03	32 37	31 58	31 19	30 53	30 14	29 49	36
40	44 48	43 44	42 56	42 08	41 36	40 48	40 16	39 28	38 40	38 08	37 20	36 48	40
44	54 13	52 55	51 57	50 59	50 20	49 22	48 43	47 45	46 47	46 08	45 10	44 32	44
48	64 30	62 58	61 49	60 40	59 54	58 45	57 59	56 50	55 41	54 55	53 46	52 59	48
52	75 42	73 54	72 33	71 12	70 18	68 57	68 03	66 42	65 21	64 27	63 06	62 11	52
56	87 49	85 43	84 09	82 35	81 32	79 58	78 55	77 21	75 37	74 44	73 10	72 08	56
60	100 48	98 24	96 36	94 48	93 36	91 48	90 36	88 48	87 00	85 48	84 00	82 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.68	1.64	1.61	1.58	1.56	1.53	1.51	1.48	1.45	1.43	1.40	1.38	$\triangle_1 h$
Log.	0.225 31	0.214 84	0.206 83	0.198 66	0.193 12	0.184 69	0.178 98	0.170 26	0.161 37	0.155 34	0.146 13	0.139 88	Log.
Limit	56	57	57	58	59	60	61	61	62	63	64	65	Minutes
Meridian	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 21	0 21	0 20	0 20	0 19	0 19	0 19	0 19	0 19	0 18	0 18	4
8	1 26	1 25	1 23	1 22	1 20	1 19	1 17	1 16	1 15	1 13	1 11	1 10	8
12	3 14	3 11	3 07	3 05	3 00	2 57	2 54	2 51	2 48	2 44	2 41	2 38	12
16	5 46	5 41	5 33	5 27	5 20	5 15	5 10	5 05	5 00	4 52	4 47	4 42	16
20	9 00	8 52	8 40	8 32	8 20	8 12	8 04	7 56	7 48	7 36	7 28	7 20	20
24	12 58	12 46	12 29	12 17	12 00	11 48	11 37	11 26	11 14	10 57	10 46	10 34	24
28	17 38	17 23	16 59	16 44	16 20	16 05	15 49	15 33	15 17	14 53	14 38	14 22	28
32	23 02	22 42	22 11	21 51	21 20	21 00	20 39	20 18	19 58	19 27	19 06	18 46	32
36	29 10	28 44	28 05	27 39	27 00	26 34	26 08	25 43	25 17	24 38	24 12	23 46	36
40	36 00	35 28	34 40	34 08	33 20	32 48	32 16	31 44	31 12	30 24	29 52	29 20	40
44	43 34	42 55	41 57	41 18	40 20	39 41	39 02	38 24	37 46	36 47	36 09	35 30	44
48	51 50	51 04	49 55	49 09	48 00	47 14	46 28	45 41	44 55	43 46	43 00	42 14	48
52	60 50	59 56	58 35	57 41	56 20	55 26	54 32	53 37	52 43	51 22	50 28	49 34	52
56	70 34	69 31	67 57	66 54	65 20	64 17	63 14	62 12	61 10	59 35	58 33	57 30	56
60	81 00	79 48	78 00	76 48	75 00	73 48	72 36	71 24	70 12	68 24	67 12	66 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.35	1.33	1.30	1.28	1.25	1.23	1.21	1.19	1.17	1.14	1.12	1.10	$\triangle_1 h$
Log.	0.130 33	0.123 85	0.113 94	0.107 21	0.096 91	0.089 91	0.082 79	0.075 55	0.068 19	0.056 90	0.049 22	0.041 39	Log.
Limit	66	67	68	69	70	71	72	73	74	75	75	76	Minutes
Meridian	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	Altitudes

Latitude 36° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 16	...	...	...	...	...	...	...	...	0 13	4
8	1 08	1 07	1 06	...	...	...	...	...	...	...	...	0 52	8
12	2 34	2 31	2 28	...	...	...	...	...	...	...	...	1 58	12
16	4 34	4 29	4 24	...	...	...	...	...	...	...	...	3 30	16
20	7 08	7 00	6 52	...	...	...	...	...	...	...	...	5 28	20
24	10 16	10 05	9 53	...	...	...	...	...	...	...	...	7 53	24
28	13 59	13 43	13 28	...	...	...	...	...	...	...	...	10 43	28
32	18 16	17 55	17 35	...	...	...	...	...	...	...	...	13 59	32
36	23 07	22 41	22 15	...	...	...	...	...	...	...	...	17 43	36
40	28 32	28 00	27 28	...	...	...	...	...	...	...	...	21 52	40
44	34 32	33 53	33 14	...	...	...	...	...	...	...	...	26 28	44
48	41 05	40 19	39 33	...	...	...	...	...	...	...	...	31 29	48
52	48 13	47 19	46 25	...	...	...	...	...	...	...	...	36 57	52
56	55 56	54 53	53 50	...	...	...	...	...	...	...	...	42 52	56
60	64 12	63 00	61 48	...	...	...	...	...	...	...	...	49 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.07	1.05	1.03	...	...	...	...	...	...	...	...	0.82	△₁h
Log.	0.029 38	0.021 19	0.012 84	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.913 81	Log.
Limit	76	77	78									82	Minutes
Meridian	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	4
8	0 51	0 50	0 48	0 47	0 45	0 43	0 42	0 40	0 39	0 38	0 36	0 34	8
12	1 54	1 51	1 48	1 45	1 42	1 37	1 35	1 30	1 27	1 25	1 21	1 16	12
16	3 22	3 17	3 12	3 07	3 02	2 54	2 49	2 42	2 37	2 31	2 23	2 16	16
20	5 16	5 08	5 00	4 52	4 44	4 32	4 24	4 12	4 04	3 56	3 44	3 32	20
24	7 35	7 23	7 12	7 00	6 49	6 32	6 21	6 03	5 52	5 40	5 23	5 05	24
28	10 20	10 04	9 48	9 33	9 17	8 53	8 37	8 14	7 58	7 43	7 19	6 56	28
32	13 29	13 09	12 48	12 28	12 07	11 36	11 15	10 45	10 24	10 04	9 33	9 03	32
36	17 04	16 38	16 12	15 46	15 20	14 42	14 16	13 37	13 11	12 45	12 06	11 27	36
40	21 04	20 32	20 00	19 28	18 56	18 08	17 36	16 48	16 16	15 44	14 56	14 08	40
44	25 29	24 51	24 12	23 33	22 54	21 57	21 18	20 20	19 41	19 02	18 04	17 06	44
48	30 18	29 32	28 46	28 00	27 14	26 06	25 20	24 11	23 25	22 39	21 20	20 21	48
52	35 36	34 42	33 48	32 54	32 00	30 38	29 44	28 23	27 29	26 35	25 14	23 53	52
56	41 17	40 15	39 12	38 09	37 06	35 33	34 30	32 56	31 53	30 50	29 16	27 42	56
60	47 24	46 12	45 00	43 48	42 36	40 48	39 36	37 48	36 36	35 24	33 36	31 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	0.59	0.77	0.75	0.73	0.71	0.68	0.66	0.63	0.61	0.59	0.56	0.53	△₁h
Log.	9.897 63	9.886 49	9.875 06	9.863 32	9.851 26	9.832 51	9.819 54	9.799 34	9.785 33	9.770 85	9.748 19	9.724 28	Log.
Limit	83	83	84	84	85	85	86	86	87	87	88	89	Minutes
Meridian	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	Altitudes

Latitude 37° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 42	0 43	0 43	0 45	0 46	0 47	0 48	0 50	0 51	0 53	0 54	0 56	4
8	2 47	2 51	2 55	2 59	3 04	3 09	3 14	3 19	3 25	3 31	3 38	3 45	8
12	6 15	6 24	6 33	6 43	6 53	7 05	7 16	7 27	7 41	7 55	8 10	8 25	12
16	11 09	11 24	11 39	11 57	12 15	12 35	12 56	13 17	13 39	14 05	14 30	14 59	16
20	17 24	17 48	18 12	18 40	19 08	19 40	20 12	20 44	21 20	22 00	22 40	23 24	20
24	25 04	25 38	26 12	26 53	27 33	28 19	29 05	29 52	30 43	31 41	32 38	33 42	24
28	34 06	34 53	35 41	36 35	37 30	38 33	39 36	40 38	41 49	43 07	44 26	45 52	28
32	44 32	45 34	46 36	47 47	48 59	50 21	51 43	53 04	54 37	56 19	58 02	59 54	32
36	56 23	57 41	58 58	60 29	62 00	63 43	65 27	67 11	69 07	71 17	73 26	75 49	36
40	69 36	71 12	72 48	74 40	76 32	78 40	80 48	82 56	85 20	88 00	90 40	...	40
44	84 13	86 10	88 05	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.61	2.67	2.73	2.80	2.87	2.95	3.03	3.11	3.20	3.30	3.40	3.51	$\triangle_1 h$
Log.	0.416 64	0.426 51	0.436 16	0.447 16	0.457 88	0.469 82	0.481 44	0.492 76	0.505 15	0.518 51	0.531 48	0.545 31	Log.
Limit	39	39	38	37	36	36	35	35	34	34	33	32	Minutes
Meridian	53°	54°	55°	56°	57°	58°	59°	60°	61°	62°	63°	64°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 58	1 00	1 02	1 05	1 07	1 10	1 13	1 17	1 21	1 25	1 30	1 35	4
8	3 52	4 01	4 09	4 19	4 30	4 40	4 53	5 07	5 23	5 40	5 59	6 22	8
12	8 42	9 02	9 20	9 42	10 06	10 31	11 00	11 31	12 06	12 44	13 29	14 20	12
16	15 30	16 02	16 36	17 14	17 58	18 41	19 32	20 29	21 30	22 40	23 59	25 28	16
20	24 12	25 04	25 56	26 56	28 04	29 12	30 32	32 00	33 36	35 24	37 28	39 48	20
24	34 51	36 06	37 21	38 47	40 25	42 03	43 58	46 05	48 23	50 59	53 58	57 18	24
28	47 26	49 08	50 50	52 47	55 01	57 14	59 51	62 43	65 51	69 23	73 26	78 01	28
32	61 57	64 10	66 23	68 57	71 51	74 45	78 10	81 55	...	...	...	...	32
36	78 25	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.63	3.76	3.89	4.04	4.21	4.38	4.58	4.80	5.04	5.31	5.62	5.97	$\triangle_1 h$
Log.	0.559 91	0.575 19	0.589 95	0.606 38	0.624 28	0.641 47	0.660 87	0.681 24	0.702 43	0.725 09	0.749 74	0.775 97	Log.
Limit	31	30	29	29	28	27	26	24	23	23	22	21	Minutes
Meridian	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 42	1 50	1 58	2 09	2 22	2 38	2 59	3 26	4 04	...	...	...	4
8	6 48	7 18	7 53	8 35	9 26	10 30	11 53	13 43	16 17	...	...	...	8
12	15 17	16 25	17 44	19 19	21 14	23 38	26 44	30 52	36 38	...	...	...	12
16	27 11	29 11	31 32	34 21	37 46	42 02	...	...	...	...	...	...	16
20	42 28	45 36	49 16	53 40	...	...	...	...	...	...	...	...	20
24	61 09	65 40	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	6.37	6.84	7.39	8.05	8.85	9.85	11.14	12.86	15.26	...	...	...	$\Delta_1 h$
Log.	0.804 14	0.835 06	0.868 64	0.905 80	0.946 94	0.993 44	1.046 89	1.109 24	1.183 55	... ...	... ...	... ...	Log.
Limit	20	19	18	17	16	14	12	11	10	8	6	4	Minutes
Meridian	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angle
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	3 34	2 55	2 28	2 07	1 51	1 39	4
8	...	...	...	...	...	...	14 16	11 42	9 53	8 30	7 25	6 34	8
12	...	...	...	...	...	...	32 05	26 20	22 14	19 08	16 43	14 47	12
16	...	...	...	...	...	...	...	46 48	39 30	34 00	29 41	26 17	16
20	...	...	...	...	...	...	...	...	...	53 08	46 24	41 04	20
24	...	...	...	...	...	...	...	...	...	...	...	59 09	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	...	...	...	13.37	10.97	9.26	7.97	6.96	6.16	$\Delta_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	1.126 13	1.040 21	0.966 61	0.901 46	0.842 61	0.789 58	Log.
Limit	2	0	2	4	6	8	10	12	14	15	17	19	Minutes
Meridian	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	Altitudes

Latitude 37° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 28	1 19	1 11	1 05	0 59	0 54	0 51	0 46	0 43	0 40	0 37	0 35	4
8	5 52	5 16	4 47	4 21	4 00	3 39	3 21	3 06	2 52	2 40	2 28	2 18	8
12	13 12	11 53	10 46	9 48	8 57	8 13	7 33	6 59	6 27	6 00	5 34	5 11	12
16	23 28	21 07	19 06	17 24	15 55	14 35	13 27	12 25	11 29	10 40	9 54	9 13	16
20	36 40	33 00	29 52	27 12	24 52	22 48	21 00	19 24	17 56	16 40	15 28	14 24	20
24	52 48	47 31	42 59	39 10	35 48	32 50	30 15	27 56	25 50	24 00	22 17	20 45	24
28	71 52	64 41	58 33	53 19	48 45	44 42	41 09	38 02	35 09	32 40	30 19	28 13	28
32	...	...	...	69 38	63 40	58 22	53 45	49 40	45 54	42 40	39 35	36 51	32
36	...	...	...	...	...	...	68 03	62 51	58 07	54 00	50 07	46 40	36
40	...	...	...	...	...	...	...	...	71 44	66 40	61 52	57 36	40
44	...	...	...	...	...	...	...	...	...	...	74 52	69 42	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.50	4.95	4.48	4.08	3.73	3.42	3.15	2.91	2.69	2.50	2.32	2.16	$\triangle_1 h$
Log.	0.740 36	0.694 61	0.651 28	0.610 66	0.571 71	0.534 03	0.498 31	0.463 89	0.429 75	0.397 94	0.365 49	0.334 45	Log.
Limit	21	23	24	25	27	29	30	31	32	34	36	38	Minutes
Meridian	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 32	0 30	0 28	0 26	0 24	0 22	0 21	0 19	0 19	0 17	0 15	0 14	4
8	2 08	2 00	1 52	1 43	1 36	1 30	1 24	1 18	1 13	1 08	1 02	0 57	8
12	4 48	4 29	4 11	3 53	3 37	3 22	3 08	2 56	2 44	2 33	2 22	2 10	12
16	8 32	7 59	7 25	6 55	6 27	5 58	5 36	5 12	4 52	4 31	4 10	3 50	16
20	13 20	12 28	11 36	10 48	10 04	9 20	8 44	8 08	7 36	7 04	6 32	6 00	20
24	19 12	17 57	16 42	15 34	14 30	13 26	12 35	11 43	10 57	10 11	9 24	8 38	24
28	26 08	24 26	22 44	21 10	19 44	18 18	17 07	15 57	14 53	13 51	12 49	11 46	28
32	34 08	31 55	29 42	27 38	25 46	23 54	22 21	20 49	19 27	18 05	16 44	15 22	32
36	43 12	40 24	37 35	35 00	32 37	30 14	28 18	26 21	24 38	22 54	21 10	19 26	36
40	53 20	49 52	46 24	43 12	40 16	37 20	34 56	32 32	30 24	28 16	26 08	24 00	40
44	64 32	60 21	56 08	52 17	48 43	45 10	42 16	39 22	36 47	34 12	31 37	29 02	44
48	76 48	71 48	66 47	62 12	57 59	53 46	50 18	46 51	43 46	40 42	37 38	34 34	48
52	...	84 16	78 25	73 00	68 03	63 06	59 02	54 59	51 22	47 46	44 10	40 34	52
56	...	...	...	84 41	78 55	73 10	68 28	63 46	59 35	55 24	51 13	47 02	56
60	...	...	...	...	...	84 00	78 36	73 12	68 24	63 36	58 48	54 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.00	1.87	1.74	1.62	1.51	1.40	1.31	1.22	1.14	1.06	0.98	0.90	$\triangle_1 h$
Log.	0.301 03	0.271 84	0.240 55	0.209 52	0.178 98	0.146 13	0.117 27	0.086 36	0.056 90	0.025 31	9.991 23	9.954 24	Log.
Limit	41	42	44	46	48	49	51	53	55	57	59	61	Minutes
Meridian	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	56°	Altitudes

DECLINATIONS

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 42	0 41	0 39	0 39	0 38	0 37	0 36	0 36	0 35	0 35	0 34	0 33	4
8	2 47	2 43	2 40	2 37	2 32	2 29	2 27	2 24	2 21	2 17	2 15	2 13	8
12	6 15	6 07	5 59	5 52	5 43	5 35	5 30	5 23	5 17	5 09	5 03	4 58	12
16	11 09	10 53	10 37	10 24	10 09	9 57	9 46	9 33	9 23	9 11	9 01	8 50	16
20	17 24	17 00	16 36	16 16	15 52	15 32	15 16	14 56	14 40	14 20	14 04	13 48	20
24	25 04	24 29	23 54	23 25	22 51	22 22	21 59	21 30	21 07	20 39	20 16	19 52	24
28	34 06	33 19	32 33	31 53	31 06	30 27	29 56	29 16	28 45	28 05	27 34	27 03	28
32	44 32	43 31	42 30	41 39	40 37	39 46	39 05	38 14	37 33	36 41	36 00	35 20	32
36	56 23	55 05	53 47	52 42	51 25	50 20	49 28	48 23	47 31	46 27	45 35	44 43	36
40	69 36	68 00	66 24	65 04	63 28	62 08	61 04	59 44	58 40	57 20	56 16	55 12	40
44	84 13	82 17	80 20	78 43	76 48	75 11	73 53	72 16	70 59	69 23	68 05	66 48	44
48	...	...	95 37	93 42	91 23	89 28	87 56	86 01	84 29	82 33	81 01	79 29	48
52	...	...	...	...	107 15	105 00	103 12	100 57	99 09	96 53	95 05	93 17	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.61	2.55	2.49	2.44	2.38	2.33	2.29	2.24	2.20	2.15	2.11	2.07	$\triangle_1 h$
Log.	0.416 64	0.406 54	0.396 20	0.387 39	0.376 58	0.367 36	0.359 84	0.350 25	0.342 42	0.332 44	0.324 28	0.315 97	Log.
Limit	39	39	40	41	42	43	43	44	44	45	46	46	Minutes
Meridian	53°	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles	
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.	
4	0 32	0 31	0 31	0 30	0 30	0 30	0 29	0 28	0 28	0 27	0 27	0 27	4	- - 2
8	2 10	2 07	2 05	2 02	2 01	1 58	1 56	1 55	1 53	1 51	1 49	1 47	8	- - 1 4
12	4 52	4 47	4 43	4 37	4 32	4 26	4 22	4 18	4 14	4 09	4 05	4 00	12	.. 3 5
16	8 40	8 29	8 21	8 11	8 04	7 54	7 46	7 38	7 30	7 23	7 15	7 08	16	-. 7 0
20	13 32	13 16	13 04	12 48	12 36	12 20	12 08	11 56	11 44	11 32	11 20	11 08	20	.. 10 5
24	19 29	19 06	18 49	18 26	18 09	17 46	17 29	17 11	16 54	16 36	16 19	16 02	24	
28	26 32	26 01	25 37	25 06	24 42	24 10	23 47	23 24	23 00	22 37	22 13	21 49	28	
32	34 39	33 58	33 27	32 46	32 15	31 34	31 03	30 33	30 02	29 32	29 01	28 30	32	
36	43 51	42 59	42 20	41 28	40 50	39 58	39 19	38 40	38 01	37 22	36 43	36 05	36	
40	54 08	53 04	52 16	51 12	50 24	49 20	48 32	47 44	46 56	46 08	45 20	44 32	40	
44	65 30	64 12	63 14	61 57	60 59	59 42	58 44	57 45	56 47	55 49	54 51	53 54	44	
48	77 57	76 25	75 16	73 44	72 34	71 02	69 53	68 42	67 33	66 24	65 15	64 07	48	
52	91 29	89 41	88 20	86 32	85 10	83 22	82 01	80 40	79 19	77 58	76 37	75 15	52	
56	106 06	104 01	102 26	100 21	98 47	96 42	95 08	93 33	91 59	90 25	88 51	87 18	56	
60	...	...	...	...	113 24	111 00	109 12	107 24	105 36	103 48	102 00	100 12	60	
	″	″	″	″	″	″	″	″	″	″	″	″		
$\triangle_1 h$	2.03	1.99	1.96	1.92	1.89	1.85	1.82	1.79	1.76	1.73	1.70	1.67	$\triangle_1 h$	
Log.	0.307 50	0.298 85	0.292 26	0.283 30	0.276 46	0.267 17	0.260 07	0.252 85	0.245 51	0.238 05	0.230 45	0.222 72	Log.	
Limit	47	48	49	50	50	51	52	53	53	54	55	56	Minutes	
Meridian	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	Altitudes	

Latitude 37° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 26	0 25	0 25	0 25	0 24	0 23	0 23	0 22	0 22	0 22	0 22	4
8	1 45	1 42	1 41	1 39	1 38	1 36	1 35	1 33	1 31	1 30	1 28	1 26	8
12	3 56	3 50	3 48	3 43	3 40	3 36	3 34	3 29	3 25	3 22	3 19	3 14	12
16	7 00	6 50	6 44	6 37	6 32	6 24	6 18	6 11	6 03	5 58	5 53	5 46	16
20	10 56	10 40	10 32	10 20	10 12	10 00	9 52	9 40	9 28	9 20	9 12	9 00	20
24	15 45	15 22	15 10	14 53	14 41	14 24	14 12	13 55	13 38	13 26	13 15	12 58	24
28	21 25	20 54	20 39	20 15	20 00	19 36	19 21	18 57	18 34	18 18	18 02	17 38	28
32	27 59	27 18	26 58	26 27	26 07	25 36	25 16	24 45	24 14	23 54	23 33	23 02	32
36	35 26	34 34	34 08	33 29	33 03	32 24	31 58	31 19	30 40	30 14	29 49	29 10	36
40	43 44	42 40	42 08	41 20	40 48	40 00	39 28	38 40	37 52	37 20	36 48	36 00	40
44	52 55	51 38	50 59	50 01	49 22	48 24	47 45	46 47	45 49	45 10	44 32	43 34	44
48	62 58	61 26	60 40	59 31	58 45	57 36	56 50	55 41	54 32	53 46	52 59	51 50	48
52	73 54	72 06	71 12	69 51	68 57	67 36	66 42	65 21	64 00	63 06	62 11	60 50	52
56	85 43	83 38	82 35	81 01	79 58	78 24	77 21	75 47	74 13	73 10	72 08	70 34	56
60	98 24	96 00	94 48	93 00	91 48	90 00	88 48	87 00	85 12	84 00	82 48	81 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.64	1.60	1.58	1.55	1.53	1.50	1.48	1.45	1.42	1.40	1.38	1.35	$\triangle_1$h
Log.	0.214 84	0.204 12	0.198 66	0.190 33	0.184 69	0.176 09	0.170 26	0.161 37	0.152 29	0.146 13	0.139 88	0.130 33	Log.
Limit	57	58	58	59	60	61	62	62	63	64	65	66	Minutes
Meridian	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 21	0 20	0 20	0 20	0 19	0 19	0 19	0 19	0 18	0 18	0 17	4
8	1 25	1 23	1 22	1 20	1 19	1 18	1 16	1 15	1 13	1 11	1 10	1 09	8
12	3 11	3 07	3 05	3 00	2 57	2 54	2 51	2 48	2 45	2 41	2 38	2 36	12
16	5 41	5 33	5 27	5 20	5 15	5 10	5 05	5 00	4 55	4 47	4 42	4 36	16
20	8 52	8 40	8 32	8 20	8 12	8 04	7 56	7 48	7 40	7 28	7 20	7 12	20
24	12 46	12 29	12 17	12 00	11 48	11 37	11 26	11 14	11 03	10 46	10 34	10 22	24
28	17 23	16 59	16 44	16 20	16 05	15 49	15 33	15 17	15 01	14 38	14 22	14 07	28
32	22 42	22 11	21 51	21 20	21 00	20 39	20 18	19 58	19 37	19 06	18 46	18 26	32
36	28 44	28 05	27 39	27 00	26 34	26 08	25 43	25 17	24 51	24 12	23 46	23 20	36
40	35 28	34 40	34 08	33 20	32 48	32 16	31 44	31 12	30 40	29 52	29 20	28 48	40
44	42 55	41 57	41 18	40 20	39 41	39 02	38 24	37 46	37 07	36 09	35 30	34 51	44
48	51 04	49 55	49 09	48 00	47 14	46 28	45 41	44 55	44 09	43 00	42 14	41 28	48
52	59 56	58 35	57 41	56 20	55 26	54 32	53 37	52 43	51 49	50 28	49 34	48 40	52
56	69 31	67 57	66 54	65 20	64 17	63 14	62 12	61 10	60 07	58 33	57 30	56 27	56
60	79 48	78 50	76 48	75 00	73 48	72 36	71 24	70 12	69 00	67 12	66 00	64 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.33	1.30	1.28	1.25	1.23	1.21	1.19	1.17	1.15	1.12	1.10	1.08	$\triangle_1$h
Log.	0.123 85	0.113 94	0.107 21	0.096 91	0.089 91	0.082 79	0.075 55	0.068 19	0.060 70	0.049 22	0.041 39	0.033 42	Log.
Limit	67	68	69	71	72	73	74	75	76	76	77	77	Minutes
Meridian	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	Altitudes

Latitude 37° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	...	...	...	...	...	...	...	...	0 13	0 13	4
8	1 07	1 06	...	...	...	...	...	...	...	...	0 53	0 52	8
12	2 31	2 28	...	...	...	...	...	...	...	...	1 59	1 56	12
16	4 29	4 24	...	...	...	...	...	...	...	...	3 33	3 28	16
20	7 00	6 52	...	...	...	...	...	...	...	...	5 32	5 24	20
24	10 05	9 53	...	...	...	...	...	...	...	...	7 58	7 47	24
28	13 43	13 28	...	...	...	...	...	...	...	...	10 51	10 35	28
32	17 55	17 35	...	...	...	...	...	...	...	...	14 10	13 49	32
36	22 41	22 15	...	...	...	...	...	...	...	...	17 56	17 30	36
40	28 00	27 28	...	...	...	...	...	...	...	...	22 08	21 36	40
44	33 53	33 14	...	...	...	...	...	...	...	...	26 47	26 08	44
48	40 19	39 33	...	...	...	...	...	...	...	...	31 52	31 06	48
52	47 19	46 25	...	...	...	...	...	...	...	...	37 24	36 30	52
56	54 53	53 50	...	...	...	...	...	...	...	...	43 23	42 20	56
60	63 00	61 48	...	...	...	...	...	...	...	...	49 48	48 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.05	1.03	...	...	...	...	...	...	...	...	0.83	0.81	$\triangle_1 h$
Log.	0.021 19	0.012 84	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.919 08	9.908 49	Log.
Limit	78	78									80	81	Minutes
Meridian	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 12	0 12	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	4
8	0 51	0 50	0 48	0 47	0 45	0 43	0 41	0 39	0 38	0 37	0 36	0 35	8
12	1 54	1 51	1 47	1 45	1 41	1 38	1 33	1 29	1 26	1 24	1 21	1 18	12
16	3 22	3 17	3 09	3 07	2 59	2 54	2 47	2 39	2 34	2 28	2 23	2 18	16
20	5 16	5 08	4 56	4 52	4 40	4 32	4 20	4 08	4 00	3 52	3 44	3 36	20
24	7 35	7 23	7 06	7 00	6 43	6 32	6 15	5 58	5 46	5 32	5 23	5 11	24
28	10 20	10 04	9 40	9 33	9 09	8 53	8 29	8 06	7 50	7 35	7 19	7 03	28
32	13 29	13 09	12 38	12 28	11 57	11 36	11 05	10 34	10 14	9 54	9 33	9 13	32
36	17 04	16 38	15 59	15 46	15 07	14 42	14 03	13 24	12 58	12 32	12 06	11 40	36
40	21 04	20 32	19 44	19 28	18 40	18 08	17 20	16 32	16 00	15 28	14 56	14 24	40
44	25 29	24 51	23 52	23 33	22 35	21 57	20 59	20 01	19 22	18 43	18 04	17 25	44
48	30 18	29 32	28 23	28 00	26 51	26 08	24 57	23 48	23 02	22 16	21 30	20 44	48
52	35 36	34 42	33 21	32 54	31 33	30 38	29 17	27 56	27 02	26 08	25 14	24 20	52
56	41 17	40 15	38 40	38 09	36 35	35 33	33 59	32 25	31 22	30 19	29 16	28 13	56
60	47 24	46 12	44 24	42 36	42 00	40 48	39 00	37 12	36 00	34 48	33 36	32 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.79	0.77	0.75	0.73	0.70	0.68	0.65	0.62	0.60	0.58	0.56	0.54	$\triangle_1 h$
Log.	9.897 63	9.886 49	9.875 06	9.863 32	9.845 10	9.832 51	9.812 91	9.792 39	9.778 15	9.763 43	9.748 19	9.732 39	Log.
Limit	82	83	84	84	85	85	86	86	86	87	87	87	Minutes
Meridian	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	Altitudes

Latitude 38° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 40	0 41	0 42	0 43	0 44	0 45	0 46	0 47	0 49	0 51	0 52	0 54	4
8	2 41	2 45	2 48	2 52	2 57	3 01	3 05	3 10	3 16	3 21	3 28	3 34	8
12	6 01	6 10	6 18	6 27	6 38	6 47	6 58	7 10	7 21	7 33	7 48	8 02	12
16	10 43	10 58	11 14	11 29	11 46	12 05	12 22	12 42	13 03	13 27	13 52	14 18	16
20	16 44	17 08	17 32	17 56	18 24	18 52	19 20	19 52	20 24	21 00	21 40	22 20	20
24	24 06	24 40	25 15	25 50	26 30	27 10	27 50	28 36	29 23	30 15	31 12	32 10	24
28	32 48	33 35	34 22	35 09	36 04	36 59	37 54	38 57	39 59	41 09	42 28	43 46	28
32	42 50	43 52	44 53	45 54	47 06	48 18	49 30	50 52	52 13	53 45	55 28	57 10	32
36	54 13	55 31	56 49	58 07	59 37	61 08	62 38	64 22	66 06	68 03	70 12	72 22	36
40	66 56	68 32	70 08	71 44	73 36	75 28	77 20	79 28	81 36	84 00	86 40	89 20	40
44	80 59	82 56	84 52	86 48	...	...	...	...	...	...	...	...	44
48	96 23	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.51	2.57	2.63	2.69	2.76	2.83	2.90	2.98	3.06	3.15	3.25	3.35	$\triangle_1 h$
Log.	0.399 67	0.409 93	0.419 96	0.429 75	0.440 91	0.451 79	0.462 40	0.474 22	0.485 72	0.498 31	0.511 88	0.525 04	Log.
Limit	40	40	39	39	38	37	37	36	36	35	34	33	Minutes
Meridian	52°	53°	54°	55°	56°	57°	58°	59°	60°	61°	62°	63°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 55	0 57	0 59	1 01	1 03	1 06	1 09	1 11	1 15	1 18	1 23	1 28	4
8	3 41	3 49	3 56	4 05	4 14	4 24	4 35	4 48	5 01	5 16	5 33	5 52	8
12	8 17	8 34	8 51	9 10	9 32	9 54	10 19	10 47	11 17	11 52	12 29	13 12	12
16	14 43	15 14	15 45	16 18	16 56	17 38	18 21	19 09	20 03	21 04	22 11	23 28	16
20	23 00	23 48	24 36	25 28	26 28	27 32	28 40	29 56	31 20	32 56	34 40	36 40	20
24	33 07	34 16	35 26	36 41	38 06	39 39	41 17	43 05	45 07	47 25	49 55	52 48	24
28	45 05	46 39	48 13	49 55	51 53	53 58	56 11	58 41	61 25	64 33	67 57	71 52	28
32	58 53	60 56	62 58	65 11	67 46	70 29	73 23	76 38	80 13	...	...	...	32
36	74 31	77 07	79 43	...	...	...	...	...	...	...	...	...	36
40	92 00	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.45	3.57	3.69	3.82	3.97	4.13	4.30	4.49	4.70	4.94	5.20	5.50	$\triangle_1 h$
Log.	0.537 82	0.552 67	0.567 03	0.582 06	0.598 79	0.615 95	0.633 47	0.652 25	0.672 10	0.693 73	0.716 00	0.740 36	Log.
Limit	32	31	30	30	29	28	27	26	25	24	23	22	Minutes
Meridian	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	Altitudes

DECLINATIONS.

/ 32

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 34	1 40	1 47	1 56	2 06	2 19	2 34	2 58	3 21	3 58	...	...	4
8	6 14	6 39	7 08	7 43	8 24	9 13	10 16	11 36	13 23	15 53	...	...	8
12	14 01	14 57	16 03	17 21	18 53	20 45	23 06	26 07	30 07	35 44	...	...	12
16	24 55	26 35	28 33	30 51	33 35	36 55	41 06	46 25	...	...	...	...	16
20	38 56	41 42	44 36	48 12	52 28	57 40	...	...	...	...	...	...	20
24	56 04	59 48	64 14	...	...	...	...	...	...	...	...	...	24
28	76 18	81 25	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.84	6.23	6.69	7.23	7.87	8.65	9.63	10.88	12.55	14.89	...	...	$\triangle_1 h$
Log.	0.766 41	0.794 49	0.825 43	0.859 14	0.895 97	0.937 02	0.983 63	1.036 63	1.098 64	1.172 89	... ...	... ...	Log.
Limit	21	20	18	17	16	15	14	13	12	10	8	6	Minutes
Meridian	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	3 27	2 51	2 23	2 03	1 49	4
8	...	...	...	...	...	...	...	13 50	11 21	9 34	8 14	7 12	8
12	...	...	...	...	...	...	...	31 10	25 33	21 34	18 32	16 12	12
16	...	...	...	...	...	...	...	...	45 27	38 18	32 56	28 48	16
20	...	...	...	...	...	...	...	...	...	...	...	45 00	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	12.98	10.65	8.98	7.72	6.75	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.113 27	1.027 35	0.953 29	0.887 62	0.829 30	Log.
Limit	4	2	0	2	4	6	8	10	12	14	16	18	Minutes
Meridian	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	Altitudes

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 35	1 25	1 16	1 09	1 03	0 58	0 53	0 49	0 45	0 42	0 38	0 35	4
8	6 21	5 40	5 06	4 37	4 12	3 50	3 31	3 15	2 59	2 46	2 34	2 22	8
12	14 19	12 44	11 29	10 23	9 28	8 38	7 55	7 18	6 43	6 13	5 46	5 20	12
16	25 25	22 40	20 23	18 29	16 48	15 22	14 05	12 58	11 57	11 03	10 14	9 28	16
20	39 44	35 24	31 52	28 52	26 16	24 00	22 00	20 16	18 40	17 16	16 00	14 48	20
24	57 13	50 59	45 53	41 34	37 49	34 34	31 41	29 11	26 53	24 52	23 02	21 19	24
28	...	...	62 26	56 35	51 29	47 02	43 07	39 43	36 35	33 51	31 22	29 01	28
32	...	...	...	...	67 15	61 26	56 19	51 53	47 47	44 12	40 58	37 53	32
36	...	...	...	...	...	...	71 17	65 40	60 29	55 57	51 50	47 57	36
40	...	...	...	...	...	...	...	...	74 40	69 04	64 00	59 12	40
44	...	...	...	...	...	...	...	...	...	...	77 26	71 38	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	5.96	5.31	4.78	4.33	3.94	3.60	3.30	3.04	2.80	2.59	2.40	2.22	$\triangle_1$h
Log.	0.775 25	0.725 09	0.679 43	0.636 49	0.595 50	0.556 30	0.518 51	0.482 87	0.447 16	0.413 30	0.380 21	0.346 35	Log.
Limit	20	22	23	24	26	28	29	30	32	34	36	38	Minutes
Meridian	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 33	0 30	0 28	0 27	0 25	0 23	0 22	0 20	0 19	0 17	0 16	0 14	4
8	2 13	2 02	1 55	1 46	1 39	1 33	1 26	1 20	1 13	1 09	1 04	0 58	8
12	4 58	4 37	4 18	3 59	3 43	3 24	3 13	2 59	2 45	2 36	2 24	2 13	12
16	8 50	8 11	7 38	7 05	6 37	6 06	5 43	5 17	4 55	4 36	4 16	3 55	16
20	13 48	12 48	11 56	11 04	10 20	9 32	8 56	8 16	7 40	7 12	6 40	6 08	20
24	19 52	18 26	17 11	15 57	14 53	13 43	12 52	11 54	11 03	10 22	9 36	8 50	24
28	27 03	25 06	23 24	21 41	20 15	18 42	17 30	16 12	15 01	14 07	13 04	12 02	28
32	35 20	32 46	30 33	28 19	26 27	24 25	22 52	21 10	19 37	18 26	17 04	15 42	32
36	44 43	41 28	38 40	35 52	33 29	30 53	28 57	26 47	24 51	23 20	21 36	19 52	36
40	55 12	51 12	47 44	44 16	41 20	38 08	35 44	33 04	30 40	28 48	26 40	24 32	40
44	66 48	61 57	57 45	53 34	50 01	46 08	43 14	40 00	37 07	34 51	32 16	29 41	44
48	79 29	73 44	68 42	63 44	59 31	54 55	51 27	47 37	44 09	41 28	38 24	35 20	48
52	...	86 32	80 40	74 48	69 51	64 27	60 23	55 53	51 49	48 40	45 04	41 28	52
56	...	...	...	...	81 01	74 44	70 02	64 48	60 07	56 27	52 16	48 05	56
60	...	...	...	...	...	...	84 24	74 24	69 00	64 48	60 00	55 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.07	1.92	1.79	1.66	1.55	1.43	1.34	1.24	1.15	1.08	1.00	0.92	$\triangle_1$h
Log.	0.315 97	0.283 30	0.252 85	0.220 11	0.190 33	0.155 34	0.127 10	0.093 42	0.060 70	0.033 42	0.00 ...	9.963 79	Log.
Limit	40	42	44	46	47	48	50	52	54	56	58	60	Minutes
Meridian	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	57°	Altitudes

Latitude 38° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 40	0 39	0 38	0 38	0 37	0 36	0 35	0 35	0 34	0 33	0 33	0 32	4
8	2 41	2 38	2 35	2 31	2 28	2 25	2 22	2 19	2 16	2 14	2 11	2 09	8
12	6 01	5 55	5 47	5 40	5 32	5 26	5 20	5 12	5 06	5 01	4 55	4 49	12
16	10 43	10 29	10 17	10 04	9 52	9 38	9 28	9 16	9 06	8 55	8 45	8 35	16
20	16 44	16 24	16 04	15 44	15 24	15 04	14 48	14 28	14 12	13 56	13 40	13 24	20
24	24 06	23 37	23 08	22 40	22 11	21 42	21 19	20 50	20 27	20 04	19 41	19 18	24
28	32 48	32 09	31 30	30 50	30 10	29 32	29 01	28 21	27 50	27 19	26 47	26 16	28
32	42 50	41 59	41 08	40 16	39 25	38 34	37 53	37 02	36 21	35 40	34 59	34 18	32
36	54 13	53 08	52 03	50 59	49 54	48 49	47 57	46 53	46 01	45 09	44 17	43 25	36
40	66 56	65 36	64 16	62 56	61 36	60 16	59 12	57 52	56 48	55 44	54 40	53 36	40
44	80 59	79 22	77 45	76 09	74 32	72 55	71 38	70 02	68 44	67 26	66 09	64 51	44
48	96 23	94 28	92 33	90 37	88 42	86 47	85 15	83 19	81 46	80 15	78 43	77 11	48
52	...	...	...	106 21	104 06	101 51	100 03	97 47	95 59	94 11	92 23	90 35	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.51	2.46	2.41	2.36	2.31	2.26	2.22	2.17	2.13	2.09	2.05	2.01	$\triangle_1 h$
Log.	0.399 67	0.390 94	0.382 02	0.372 91	0.363 61	0.354 11	0.346 35	0.336 46	0.328 38	0.320 15	0.311 75	0.303 20	Log.
Limit	40	40	41	42	43	43	44	45	45	46	47	48	Minutes
Meridian	52°	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 31	0 30	0 30	0 30	0 29	0 28	0 28	0 27	0 27	0 27	0 26	4
8	2 06	2 04	2 02	2 00	1 58	1 56	1 54	1 52	1 50	1 48	1 46	1 44	8
12	4 46	4 40	4 35	4 29	4 25	4 20	4 16	4 11	4 06	4 03	3 59	3 54	12
16	8 26	8 16	8 09	7 59	7 51	7 44	7 33	7 25	7 18	7 13	7 05	6 58	16
20	13 12	12 56	12 44	12 28	12 16	12 04	11 48	11 36	11 24	11 16	11 04	10 52	20
24	19 00	18 37	18 20	17 57	17 40	17 23	16 59	16 42	16 25	16 14	15 57	15 39	24
28	25 53	25 21	24 58	24 26	24 02	23 39	23 08	22 44	22 21	22 05	21 41	21 18	28
32	33 48	33 07	32 36	31 55	31 24	30 53	30 13	29 42	29 11	28 50	28 19	27 49	32
36	42 46	41 54	41 15	40 24	39 45	39 06	38 14	37 35	36 56	36 31	35 52	35 13	36
40	52 48	51 44	50 56	49 52	49 04	48 16	47 12	46 24	45 36	45 04	44 16	43 28	40
44	63 53	62 35	61 37	60 21	59 22	58 24	57 07	56 08	55 10	54 32	53 34	52 36	44
48	76 02	74 30	73 21	71 48	70 39	69 30	67 56	66 47	65 38	64 53	63 44	62 35	48
52	89 14	87 26	86 05	84 16	82 55	81 34	79 46	78 25	77 04	76 09	74 48	73 27	52
56	103 29	101 23	99 49	97 45	96 10	94 36	92 31	90 56	89 22	88 20	86 46	85 12	56
60	...	...	114 36	112 12	110 24	108 36	106 12	104 24	102 36	101 24	99 36	97 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.98	1.94	1.91	1.87	1.84	1.81	1.77	1.74	1.71	1.69	1.66	1.63	$\triangle_1 h$
Log.	0.296 67	0.287 80	0.281 03	0.271 84	0.264 82	0.257 68	0.247 97	0.240 55	0.233 00	0.227 89	0.220 11	0.212 19	Log.
Limit	49	50	51	51	51	52	53	54	54	54	55	56	Minutes
Meridian	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	Altitudes

Latitude 38° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 26	0 25	0 25	0 24	0 23	0 23	0 23	0 22	0 22	0 22	0 22	0 22	4
8	1 42	1 41	1 39	1 37	1 36	1 35	1 33	1 31	1 30	1 28	1 26	1 25	8
12	3 50	3 46	3 42	3 39	3 35	3 32	3 29	3 25	3 22	3 17	3 14	3 11	12
16	6 50	6 42	6 34	6 29	6 21	6 16	6 11	6 03	5 58	5 51	5 46	5 41	16
20	10 40	10 28	10 16	10 08	9 56	9 48	9 40	9 28	9 20	9 08	9 00	8 52	20
24	15 22	15 04	14 47	14 36	14 18	14 06	13 55	13 38	13 26	13 09	12 58	12 46	24
28	20 54	20 31	20 07	19 52	19 29	19 13	18 57	18 34	18 18	17 54	17 38	17 23	28
32	27 18	26 48	26 17	25 56	25 26	25 06	24 45	24 14	23 54	23 23	23 02	22 42	32
36	34 34	33 55	33 16	32 50	32 11	31 45	31 19	30 40	30 14	29 36	29 10	28 44	36
40	42 40	41 52	41 04	40 32	39 44	39 12	38 40	37 52	37 20	36 32	36 00	35 28	40
44	51 38	50 40	49 41	49 03	48 04	47 26	46 47	45 49	45 10	44 13	43 34	42 55	44
48	61 26	60 17	59 08	58 22	57 13	56 27	55 41	54 32	53 46	52 36	51 50	51 04	48
52	72 06	70 45	69 24	68 30	67 09	66 15	65 21	64 00	63 06	61 44	60 58	59 56	52
56	83 38	82 04	80 29	79 27	77 52	76 50	75 47	74 13	73 10	71 37	70 34	69 31	56
60	96 00	94 12	92 24	91 12	89 24	88 12	87 00	85 12	84 00	82 12	81 00	79 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.60	1.57	1.54	1.52	1.49	1.47	1.45	1.42	1.40	1.37	1.35	1.33	$\triangle_1 h$
Log.	0.204 12	0.195 90	0.187 52	0.181 84	0.173 19	0.167 32	0.161 37	0.152 29	0.146 13	0.136 72	0.130 33	0.123 85	Log.
Limit	57	58	59	60	61	62	62	63	64	65	66	67	Minutes
Meridian	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 21	0 20	0 20	0 20	0 19	0 19	0 19	0 19	0 19	0 18	0 17	0 17	4
8	1 23	1 22	1 21	1 20	1 18	1 16	1 15	1 13	1 12	1 11	1 09	1 08	8
12	3 07	3 05	3 02	2 59	2 54	2 51	2 48	2 45	2 42	2 39	2 36	2 33	12
16	5 33	5 27	5 22	5 17	5 10	5 05	5 00	4 55	4 50	4 45	4 36	4 31	16
20	8 40	8 32	8 24	8 16	8 04	7 56	7 48	7 40	7 32	7 24	7 12	7 04	20
24	12 29	12 17	12 06	11 54	11 37	11 26	11 14	11 03	10 51	10 40	10 22	10 11	24
28	16 59	16 44	16 28	16 12	15 49	15 33	15 17	15 01	14 46	14 30	14 07	13 51	28
32	22 11	21 51	21 30	21 10	20 39	20 18	19 58	19 37	19 17	18 56	18 26	18 05	32
36	28 05	27 39	27 13	26 47	26 08	25 43	25 17	24 51	24 25	23 59	23 20	22 54	36
40	34 40	34 08	33 36	33 04	32 16	31 44	31 12	30 40	30 08	29 36	28 48	28 16	40
44	41 57	41 18	40 38	40 00	39 02	38 24	37 46	37 07	36 28	35 49	34 51	34 12	44
48	49 55	49 09	48 23	47 37	46 28	45 41	44 55	44 09	43 23	42 37	41 28	40 42	48
52	58 35	57 41	56 47	55 53	54 32	53 37	52 43	51 49	50 55	50 01	48 40	47 46	52
56	67 57	66 54	65 51	64 48	63 14	62 12	61 10	60 07	59 04	58 01	56 27	55 24	56
60	78 00	76 48	75 36	74 24	72 36	71 24	70 12	69 00	67 48	66 36	64 48	63 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.30	1.28	1.26	1.24	1.21	1.19	1.17	1.15	1.13	1.11	1.08	1.06	$\triangle_1 h$
Log.	0.113 94	0.107 21	0.100 37	0.093 42	0.082 79	0.075 55	0.068 19	0.060 70	0.053 08	0.045 32	0.033 42	0.025 31	Log.
Limit	67	68	69	70	72	73	74	75	76	77	78	79	Minutes
Meridian	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	Altitudes

Latitude 38° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	...	0 14	0 13	0 13	4
8	...	...	...	...	...	...	...	...	...	0 54	0 52	0 51	8
12	...	...	...	...	...	...	...	...	...	2 01	1 58	1 55	12
16	...	...	...	...	...	...	...	...	...	3 35	3 30	3 25	16
20	...	...	...	...	...	...	...	...	...	5 36	5 28	5 20	20
24	...	...	...	...	...	...	...	...	...	8 04	7 53	7 41	24
28	...	...	...	...	...	...	...	...	...	10 58	10 43	10 27	28
32	...	...	...	...	...	...	...	...	...	14 20	13 59	13 39	32
36	...	...	...	...	...	...	...	...	...	18 09	17 43	17 17	36
40	...	...	...	...	...	...	...	...	...	22 24	21 52	21 20	40
44	...	...	...	...	...	...	...	...	...	27 06	26 28	25 49	44
48	...	...	...	...	...	...	...	...	...	32 15	31 29	30 43	48
52	...	...	...	...	...	...	...	...	...	37 51	36 57	36 03	52
56	...	...	...	...	...	...	...	...	...	43 54	42 52	41 49	56
60	...	...	...	...	...	...	...	...	...	50 24	49 12	48 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	...	...	0.84	0.82	0.80	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.924 28	9.913 81	9.903 09	Log.
Limit										78	79	81	Minutes
Meridian	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	4
8	0 50	0 49	0 48	0 46	0 44	0 43	0 41	0 39	0 28	0 37	0 36	0 35	8
12	1 53	1 50	1 47	1 44	1 39	1 36	1 33	1 29	1 26	1 24	1 21	1 18	12
16	3 19	3 14	3 09	3 04	2 57	2 52	2 47	2 39	2 34	2 28	2 23	2 18	16
20	5 12	5 04	4 56	4 48	4 36	4 28	4 20	4 08	4 00	3 52	3 44	3 36	20
24	7 29	7 18	7 06	6 55	6 38	6 26	6 15	5 58	5 46	5 32	5 23	5 11	24
28	10 12	9 56	9 40	9 25	9 01	8 45	8 29	8 06	7 50	7 35	7 19	7 03	28
32	13 19	12 58	12 38	12 17	11 46	11 26	11 05	10 34	10 14	9 54	9 33	9 13	32
36	16 51	16 25	15 59	15 33	14 55	14 29	14 03	13 24	12 58	12 32	12 06	11 40	36
40	20 48	20 16	19 44	19 12	18 24	17 52	17 20	16 32	16 00	15 28	14 56	14 24	40
44	25 10	24 31	23 52	23 14	22 16	21 38	20 59	20 01	19 22	18 43	18 04	17 25	44
48	29 55	29 09	28 23	27 37	26 29	25 43	24 57	23 48	23 02	22 16	21 30	20 44	48
52	35 09	34 15	33 21	32 27	31 05	30 11	29 17	27 56	27 02	26 08	25 14	24 20	52
56	40 46	39 44	38 40	37 38	36 04	35 02	33 59	32 25	31 22	30 19	29 16	28 13	56
60	46 48	45 36	44 24	43 12	41 24	40 12	39 00	37 12	36 00	34 48	33 36	32 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.78	0.76	0.74	0.72	0.69	0.67	0.65	0.62	0.60	0.58	0.56	0.54	$\triangle_1 h$
Log.	9.892 09	9.880 81	9.869 23	9.857 33	9.838 85	9.826 07	9.812 91	9.792 39	9.778 15	9.763 43	9.748 19	9.732 39	Log.
Limit	82	83	83	84	84	85	85	85	86	86	87	88	Minutes
Meridian	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	Altitudes

Latitude 39° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 39	0 40	0 41	0 43	0 43	0 44	0 46	0 46	0 48	0 50	0 51	4
8	2 35	2 39	2 42	2 46	2 49	2 54	2 59	3 03	3 07	3 13	3 18	3 24	8
12	5 49	5 58	6 04	6 13	6 21	6 32	6 42	6 52	7 02	7 13	7 26	7 39	12
16	10 19	10 34	10 48	11 03	11 19	11 36	11 54	12 12	12 30	12 51	13 14	13 37	16
20	16 08	16 32	16 52	17 16	17 40	18 08	18 36	19 04	19 32	20 04	20 40	21 16	20
24	23 14	23 48	24 17	24 52	25 27	26 07	26 47	27 28	28 07	28 54	29 46	30 38	24
28	31 38	32 25	33 04	33 51	34 37	35 33	36 28	37 22	38 18	39 20	40 30	41 41	28
32	41 18	42 20	43 11	44 12	45 13	46 25	47 37	48 48	50 01	51 22	52 54	54 26	32
36	52 16	53 34	54 39	55 57	57 15	58 45	60 16	61 47	63 17	65 01	66 58	68 55	36
40	64 32	66 08	67 28	69 04	70 40	72 32	74 24	76 16	78 08	80 16	82 40	85 04	40
44	78 05	80 01	81 38	83 34	85 31	87 46	...	...	...	...	...	...	44
48	92 56	95 14	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.42	2.48	2.53	2.59	2.65	2.72	2.79	2.86	2.93	3.01	3.10	3.19	$\triangle_1 h$
Log.	0.383 82	0.394 45	0.403 12	0.413 30	0.423 25	0.434 57	0.445 60	0.456 37	0.466 87	0.478 57	0.491 36	0.503 79	Log.
Limit	41	41	40	39	39	38	38	37	36	36	35	34	Minutes
Meridian	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	61°	62°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 52	0 54	0 56	0 58	1 00	1 02	1 05	1 07	1 10	1 14	1 18	1 22	4
8	3 31	3 37	3 44	3 51	4 00	4 09	4 19	4 30	4 42	4 55	5 10	5 26	8
12	7 54	8 08	8 24	8 41	9 00	9 22	9 43	10 08	10 34	11 03	11 37	12 14	12
16	14 02	14 28	14 56	15 27	16 00	16 38	17 17	18 00	18 46	19 41	20 39	21 46	16
20	21 56	22 36	23 20	24 08	25 00	26 00	27 00	28 08	29 20	30 44	32 16	34 00	20
24	31 35	32 33	33 36	34 46	36 00	37 26	38 53	40 31	42 14	44 16	46 28	48 58	24
28	43 00	44 18	45 44	47 18	49 00	50 58	52 55	55 09	57 30	60 14	63 14	66 38	28
32	56 09	57 51	59 44	61 46	64 00	66 34	69 07	72 01	75 06	78 40	82 36	...	32
36	71 04	73 14	75 36	78 12	...	...	...	...	...	...	...	...	36
40	87 44	90 24	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.29	3.39	3.50	3.62	3.75	3.90	4.05	4.22	4.40	4.61	4.84	5.10	$\triangle_1 h$
Log.	0.517 20	0.530 20	0.544 07	0.558 71	0.574 03	0.591 06	0.607 46	0.625 31	0.643 45	0.663 70	0.684 85	0.707 57	Log.
Limit	33	32	31	31	31	30	29	28	27	26	25	24	Minutes
Meridian	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	Altitudes

Latitude 39° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 26	1 31	1 38	1 45	1 53	2 03	2 15	2 30	2 50	3 16	3 52	...	4
8	5 46	6 06	6 30	6 59	7 32	8 12	9 01	10 02	11 19	13 04	15 29	...	8
12	12 56	13 44	14 38	15 42	16 57	18 27	20 17	22 34	25 29	29 23	34 49	...	12
16	23 00	24 24	26 02	27 54	30 07	32 49	36 03	40 06	45 19	...	...	...	16
20	35 56	38 08	40 40	43 36	47 04	51 16	56 20	...	...	...	...	...	20
24	51 45	54 55	58 34	62 47	...	...	...	...	...	...	...	...	24
28	70 26	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.39	5.72	6.10	6.54	7.06	7.69	8.45	9.40	10.62	12.24	14.51	...	$\triangle_1 h$
Log.	0.731 59	0.757 40	0.785 33	0.815 58	0.848 80	0.885 93	0.926 86	0.973 13	1.026 12	1.087 78	1.161 67	... ...	Log.
Limit	23	21	20	19	18	17	16	15	14	12	10	8	Minutes
Meridian	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	3 21	2 45	2 19	1 59	4
8	...	...	...	...	...	...	...	...	13 26	11 00	9 17	7 59	8
12	...	...	...	...	...	...	...	...	30 13	24 46	20 53	17 56	12
16	...	...	...	...	...	...	...	...	...	44 02	37 07	31 52	16
20	...	...	...	...	...	...	...	...	...	...	...	49 48	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	...	12.59	10.32	8 70	7.47	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.100 03	1.013 68	0.939 52	0.873 32	Log.
Limit	6	4	2	0	2	4	6	8	10	12	14	16	Minutes
Meridian	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	Altitudes

Latitude 39° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 44	1 32	1 23	1 14	1 07	1 01	0 55	0 51	0 46	0 43	0 39	0 37	4
8	6 57	6 09	5 29	4 55	4 27	4 03	3 42	3 23	3 06	2 52	2 39	2 27	8
12	15 39	13 50	12 20	11 05	10 02	9 07	8 20	7 38	7 01	6 27	5 58	5 31	12
16	27 49	24 34	21 56	19 43	17 50	16 13	14 48	13 34	12 27	11 29	10 34	9 49	16
20	43 38	38 24	34 16	30 48	27 52	25 20	23 08	21 12	19 28	17 56	16 32	15 20	20
24	62 36	55 18	49 21	44 22	40 08	36 29	33 18	30 32	28 02	25 50	23 48	22 05	24
28	...	...	...	60 22	54 37	49 39	45 21	41 33	38 10	35 09	32 25	30 03	28
32	...	...	...	...	...	64 51	59 14	54 16	49 50	45 54	42 20	39 15	32
36	...	...	...	...	...	...	...	68 42	63 04	58 07	53 34	49 41	36
40	...	...	...	...	...	...	...	...	...	71 44	66 08	61 20	40
44	...	...	...	...	...	...	...	...	...	...	80 01	74 13	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.52	5.76	5.14	4.62	4.18	3.80	3.47	3.18	2.92	2.69	2.48	2.30	$\triangle_1 h$
Log.	0.814 25	0.760 42	0.710 96	0.664 64	0.621 18	0.579 78	0.540 33	0.502 43	0.465 38	0.429 75	0.394 45	0.361 73	Log.
Limit	18	20	21	22	24	26	28	29	31	33	35	37	Minutes
Meridian	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 34	0 31	0 30	0 27	0 25	0 23	0 22	0 20	0 19	0 17	0 16	0 14	4
8	2 16	2 06	1 57	1 49	1 41	1 35	1 28	1 21	1 15	1 10	1 05	0 59	8
12	5 06	4 44	4 23	4 05	3 48	3 32	3 17	3 02	2 48	2 37	2 25	2 14	12
16	9 06	8 24	7 49	7 15	6 44	6 16	5 51	5 22	5 00	4 39	4 19	3 58	16
20	14 12	13 08	12 12	11 20	10 32	9 48	9 08	8 24	7 48	7 16	6 44	6 12	20
24	20 27	18 44	17 34	16 19	15 10	14 06	13 09	12 06	11 14	10 28	9 42	8 55	24
28	27 50	25 45	23 55	22 13	20 39	19 13	17 54	16 28	15 17	14 15	13 12	12 10	28
32	36 21	33 38	31 14	29 01	26 58	25 06	23 23	21 30	19 58	18 36	17 14	15 53	32
36	46 01	42 33	39 32	36 43	34 08	31 45	29 36	27 13	25 17	23 33	21 49	20 05	36
40	56 48	52 32	48 48	45 20	42 08	39 12	36 32	33 36	31 12	29 04	26 56	24 48	40
44	68 44	63 34	59 03	54 51	50 59	47 26	44 13	40 39	37 46	35 10	32 35	30 00	44
48	...	75 39	70 16	65 15	60 40	56 27	52 36	48 23	44 55	41 51	38 47	35 43	48
52	...	...	82 28	76 37	71 12	66 15	61 44	56 47	52 43	49 07	45 31	41 55	52
56	...	...	...	88 51	82 35	76 50	71 37	65 51	61 10	56 58	52 47	48 36	56
60	...	...	...	...	...	...	82 12	75 36	70 12	65 24	60 36	55 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.13	1.97	1.83	1.70	1.58	1.47	1.37	1.26	1.17	1.09	1.01	0.93	$\triangle_1 h$
Log.	0.328 38	0.294 47	0.262 45	0.230 45	0.198 66	0.167 32	0.136 72	0.100 37	0.068 19	0.037 43	0.004 32	9.968 48	Log.
Limit	39	41	43	45	47	48	49	51	53	55	57	59	Minutes
Meridian	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	58°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 38	0 37	0 36	0 35	0 35	0 35	0 34	0 33	0 32	0 31	0 31	4
8	2 35	2 32	2 28	2 26	2 23	2 20	2 17	2 15	2 13	2 10	2 07	2 05	8
12	5 49	5 41	5 34	5 29	5 21	5 15	5 09	5 03	4 58	4 52	4 47	4 43	12
16	10 19	10 07	9 54	9 43	9 31	9 21	9 11	9 01	8 50	8 40	8 29	8 21	16
20	16 08	15 48	15 28	15 12	14 52	14 36	14 20	14 04	13 48	13 32	13 16	13 04	20
24	23 14	22 45	22 17	21 53	21 24	21 02	20 39	20 16	19 52	19 29	19 06	18 49	24
28	31 38	30 58	30 19	29 48	29 09	28 37	28 05	27 34	27 03	26 32	26 01	25 37	28
32	41 18	40 27	39 35	38 55	38 04	37 22	36 41	36 00	35 20	34 39	33 58	33 27	32
36	52 16	51 12	50 07	49 15	48 10	47 19	46 27	45 35	44 43	43 51	42 59	42 20	36
40	64 32	63 12	61 52	60 48	59 28	58 24	57 20	56 16	55 12	54 08	53 04	52 16	40
44	78 05	76 39	74 52	73 34	71 57	70 40	69 23	68 05	66 48	65 30	64 12	63 14	44
48	92 56	91 00	89 05	87 33	85 38	84 05	82 33	81 01	79 29	77 57	76 25	75 16	48
52	...	106 48	104 33	102 45	100 30	98 41	96 53	95 05	93 17	91 29	89 41	88 20	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1h$	2.42	2.37	2.32	2.28	2.23	2.19	2.15	2.11	2.07	2.03	1.99	1.96	$\triangle_1h$
Log.	0.383 82	0.374 75	0.365 49	0.357 93	0.348 30	0.340 44	0.332 44	0.324 28	0.315 97	0.307 50	0.298 85	0.292 26	Log.
Limit	41	41	42	43	44	45	45	46	46	47	48	48	Minutes
Meridian	51°	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 30	0 30	0 29	0 28	0 28	0 27	0 27	0 27	0 27	0 26	0 25	4
8	2 02	2 01	1 58	1 56	1 55	1 53	1 51	1 49	1 47	1 45	1 43	1 42	8
12	4 37	4 32	4 26	4 22	4 18	4 14	4 09	4 05	4 00	3 56	3 53	3 49	12
16	8 11	8 04	7 54	7 46	7 38	7 30	7 23	7 15	7 08	7 00	6 55	6 47	16
20	12 48	12 36	12 20	12 08	11 56	11 44	11 32	11 20	11 08	10 56	10 48	10 36	20
24	18 26	18 09	17 46	17 29	17 11	16 54	16 36	16 19	16 02	15 45	15 34	15 16	24
28	25 06	24 42	24 10	23 47	23 24	23 00	22 37	22 13	21 49	21 25	21 10	20 47	28
32	32 46	32 15	31 34	31 03	30 33	30 02	29 32	29 01	28 30	27 59	27 38	27 08	32
36	41 28	40 50	39 58	39 19	38 40	38 01	37 22	36 43	36 05	35 26	35 00	34 21	36
40	51 12	50 24	49 20	48 32	47 44	46 56	46 08	45 20	44 32	43 44	43 12	42 24	40
44	61 57	60 59	59 42	58 44	57 45	56 47	55 49	54 51	53 54	52 55	52 17	51 18	44
48	73 44	72 34	71 02	69 53	68 42	67 33	66 24	65 15	64 07	62 58	62 12	61 03	48
52	86 32	85 10	83 22	82 01	80 40	79 19	77 58	76 37	75 15	73 54	73 00	71 39	52
56	100 21	98 47	96 42	95 08	93 33	91 59	90 25	88 51	87 18	85 43	84 41	83 06	56
60	...	113 24	111 00	109 12	107 24	105 36	103 48	102 00	100 12	98 24	97 12	95 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1h$	1.92	1.89	1.85	1.82	1.79	1.76	1.73	1.70	1.67	1.64	1.62	1.59	$\triangle_1h$
Log.	0.283 30	0.276 46	0.267 17	0.260 07	0.252 85	0.245 51	0.238 05	0.230 45	0.222 72	0.214 84	0.209 52	0.201 40	Log.
Limit	49	50	51	52	52	53	54	55	55	56	57	58	Minutes
Meridian	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	Altitudes

Latitude 39° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 25	0 24	0 23	0 23	0 23	0 22	0 22	0 22	0 22	0 22	0 21	4
8	1 40	1 38	1 37	1 36	1 34	1 33	1 31	1 29	1 28	1 26	1 25	1 23	8
12	3 45	3 40	3 37	3 35	3 31	3 28	3 25	3 20	3 17	3 14	3 11	3 07	12
16	6 39	6 32	6 27	6 21	6 13	6 08	6 03	5 56	5 51	5 46	5 41	5 33	16
20	10 24	10 12	10 04	9 56	9 44	9 36	9 28	9 16	9 08	9 00	8 52	8 40	20
24	14 59	14 41	14 30	14 18	14 01	13 49	13 38	13 21	13 09	12 58	12 46	12 29	24
28	20 23	20 00	19 44	19 29	19 05	18 49	18 34	18 10	17 54	17 38	17 23	16 59	28
32	26 37	26 07	25 46	25 26	24 55	24 35	24 14	23 43	23 23	23 02	22 42	22 11	32
36	33 42	33 03	32 37	32 11	31 32	31 06	30 40	30 02	29 36	29 10	28 44	28 05	36
40	41 36	40 48	40 16	39.44	38 56	38 24	32 52	37 04	36 32	36 00	35 28	34 40	40
44	50 20	49 22	48 43	48 04	47 06	46 27	45 49	44 51	44 13	43 34	42 55	41 57	44
48	59 54	58 45	57 59	57 13	56 04	55 18	54 32	53 22	52 36	51 50	51 04	49 55	48
52	70 18	68 57	68 03	67 09	65 48	64 54	64 00	62 38	61 44	60 50	59 56	58 35	52
56	81 32	79 58	78 55	77 52	76 18	75 15	74 13	72 39	71 37	70 34	69 31	67 57	56
60	93 36	91 48	90 36	89 24	87 36	86 24	85 12	83 24	82 12	81 00	79 48	78 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.56	1.53	1.51	1.49	1.46	1.44	1.42	1.39	1.37	1.35	1.33	1.30	$\Delta_1 h$
Log.	0.193 12	0.184 69	0.178 98	0.173 19	0.164 35	0.158 36	0.152 29	0.143 01	0.136 72	0.130 33	0.123 85	0.113 94	Log.
Limit	59	59	59	60	61	62	63	63	64	65	66	67	Minutes
Meridian	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 20	0 19	0 19	0 19	0 19	0 19	0 19	0 18	0 17	0 17	...	4
8	1 22	1 21	1 19	1 17	1 16	1 15	1 13	1 12	1 11	1 10	1 09	...	8
12	3 05	3 02	2 57	2 54	2 51	2 48	2 45	2 42	2 39	2 37	2 34	...	12
16	5 27	5 22	5 15	5 10	5 05	5 00	4 55	4 50	4 45	4 39	4 34	...	16
20	8 32	8 24	8 12	8 04	7 56	7 48	7 40	7 32	7 24	7 16	7 08	...	20
24	12 17	12 06	11 48	11 37	11 26	11 14	11 03	10 51	10 40	10 28	10 16	...	24
28	16 44	16 28	16 05	15 49	15 33	15 17	15 01	14 46	14 30	14 15	13 59	...	28
32	21 51	21 30	21 00	20 39	20 18	19 58	19 37	19 17	18 56	18 36	18 16	...	32
36	27 39	27 13	26 34	26 08	25 43	25 17	24 51	24 25	23 59	23 33	23 07	...	36
40	34 08	33 36	32 48	32 16	31 44	31 12	30 40	30 08	29 36	29 04	28 32	...	40
44	41 18	40 39	39 41	39 02	38 24	37 46	37 07	36 28	35 49	35 10	34 32		44
48	49 09	48 23	47 14	46 28	45 41	44 55	44 09	43 23	42 37	41 51	41 05	...	48
52	57 41	56 47	55 26	54 32	53 37	52 43	51 49	50 55	50 01	49 07	48 13	...	52
56	66 54	65 51	64 17	63 14	62 12	61 10	60 07	59 04	58 01	56 58	55 56	...	56
60	76 48	75 36	73 48	72 36	71 24	70 12	69 00	67 48	66 36	65 24	64 12	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.28	1.26	1.23	1.21	1.19	1.17	1.15	1.13	1.11	1.09	1.07	...	$\Delta_1 h$
Log.	0.107 21	0.100 37	0.089 91	0.082 79	0.075 55	0.068 19	0.060 70	0.053 08	0.045 32	0.037 43	0.029 38	... ...	Log.
Limit	68	69	70	71	73	74	75	76	77	77	77		Minutes
Meridian	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	0 14	0 14	0 13	0 12	4
8	...	...	...	...	...	...	...	...	0 55	0 53	0 52	0 51	8
12	...	...	...	...	...	...	...	...	2 04	1 59	1 56	1 54	12
16	...	...	...	...	...	...	...	...	3 40	3 33	3 28	3 22	16
20	...	...	...	...	...	...	...	...	5 44	5 32	5 24	5 16	20
24	...	...	...	...	...	...	...	...	8 16	7 58	7 47	7 35	24
28	...	...	...	...	...	...	...	...	11 14	10 51	10 35	10 20	28
32	...	...	...	...	...	...	...	...	14 40	14 10	13 49	13 29	32
36	...	...	...	...	...	...	...	...	18 35	17 56	17 30	17 04	36
40	...	...	...	...	...	...	...	...	22 56	22 08	21 36	21 04	40
44	...	...	...	...	...	...	...	...	27 45	26 47	26 08	25 29	44
48	...	...	...	...	...	...	...	...	33 01	31 52	31 06	30 18	48
52	...	...	...	...	...	...	...	...	38 45	37 24	36 30	35 36	52
56	...	...	...	...	...	...	...	...	44 57	43 23	42 20	41 17	56
60	...	...	...	...	...	...	...	...	51 36	49 48	48 36	47 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	...	...	...	...	...	0.86	0.83	0.81	0.79	$\Delta_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.934 5 0	9.919 08	9.908 49	9.897 63	Log.
Limit									76	78	79	81	Minutes
Meridian	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 10	0 09	0 09	0 09	0 09	4
8	0 50	0 49	0 47	0 46	0 44	0 42	0 41	0 39	0 38	0 37	0 35	0 34	8
12	1 51	1 50	1 45	1 42	1 39	1 35	1 32	1 27	1 25	1 22	1 19	1 16	12
16	3 17	3 14	3 07	3 02	2 57	2 49	2 44	2 37	2 31	2 26	2 21	2 16	16
20	5 08	5 04	4 52	4 44	4 36	4 24	4 16	4 04	3 56	3 48	3 40	3 32	20
24	7 23	7 18	7 00	6 49	6 38	6 21	6 09	5 52	5 40	5 28	5 17	5 05	24
28	10 04	9 56	9 33	9 17	9 01	8 37	8 21	7 58	7 43	7 27	7 11	6 56	28
32	13 09	12 58	12 28	12 07	11 46	11 15	10 55	10 24	10 04	9 44	9 23	9 03	32
36	16 38	16 25	15 46	15 20	14 55	14 16	13 50	13 11	12 45	12 19	11 53	11 27	36
40	20 32	20 16	19 28	18 56	18 24	17 36	17 04	16 16	15 44	15 12	14 40	14 08	40
44	24 51	24 31	23 33	22 54	22 16	21 18	20 39	19 41	19 02	18 24	17 45	17 06	44
48	29 32	29 09	28 00	27 14	26 29	25 20	24 34	23 25	22 39	21 53	21 07	20 21	48
52	34 42	34 15	32 54	32 00	31 05	29 44	28 50	27 29	26 35	25 41	24 47	23 53	52
56	40 15	39 44	38 09	37 06	36 04	34 30	33 27	31 53	30 50	29 48	28 45	27 42	56
60	46 12	45 36	43 48	42 36	41 24	39 36	38 24	36 36	35 24	34 12	33 00	31 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.77	0.76	0.73	0.71	0.69	0.66	0.64	0.61	0.59	0.57	0.55	0.53	$\Delta_1 h$
Log.	9.886 49	9.880 81	9.863 32	9.851 26	9.838 85	9.819 54	9.806 18	9.785 33	9.770 85	9.755 87	9.740 36	9.724 28	Log.
Limit	82	83	83	84	84	85	85	85	86	86	87	87	Minutes
Meridian	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 38	0 39	0 40	0 41	0 42	0 43	0 44	0 45	0 46	0 47	0 49	4
8	2 30	2 33	2 37	2 40	2 43	2 47	2 51	2 56	3 00	3 04	3 09	3 15	8
12	5 37	5 44	5 52	6 00	6 07	6 15	6 26	6 35	6 44	6 55	7 07	7 19	12
16	9 59	10 12	10 24	10 40	10 53	11 09	11 26	11 41	12 00	12 17	12 37	13 01	16
20	15 36	15 56	16 16	16 40	17 00	17 24	17 52	18 16	18 44	19 12	19 44	20 20	20
24	22 28	22 57	23 25	24 00	24 29	25 04	25 44	26 18	26 59	27 39	28 25	29 17	24
28	30 34	31 14	31 53	32 40	33 19	34 06	35 01	35 48	36 43	37 38	38 41	39 51	28
32	39 56	40 47	41 39	42 40	43 31	44 32	45 44	46 46	47 57	49 09	50 31	52 03	32
36	50 33	51 38	52 42	54 00	55 05	56 23	57 54	59 11	60 42	62 13	63 56	65 53	36
40	62 24	63 44	65 04	66 40	68 00	69 36	71 28	73 04	74 56	76 48	78 56	81 20	40
44	75 30	77 07	78 43	80 40	82 17	84 13	86 29	88 24	...	...	...	...	44
48	89 51	91 46	93 42	96 00	...	...	...	...	...	...	...	...	48
52	105 27	107 42	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.34	2.39	2.44	2.50	2.55	2.61	2.68	2.74	2.81	2.88	2.96	3.05	$\triangle_1 h$
Log.	0.369 22	0.378 40	0.387 39	0.397 94	0.406 54	0.416 64	0.428 13	0.437 75	0.448 71	0.459 39	0.471 29	0.484 30	Log.
Limit	42	42	41	41	40	39	39	38	37	37	36	35	Minutes
Meridian	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	61°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 50	0 51	0 53	0 55	0 57	0 59	1 01	1 03	1 06	1 09	1 12	1 16	4
8	3 20	3 27	3 33	3 41	3 47	3 55	4 05	4 14	4 24	4 36	4 49	5 04	8
12	7 30	7 45	7 59	8 16	8 31	8 50	9 11	9 32	9 54	10 20	10 49	11 23	12
16	13 22	13 47	14 13	14 40	15 09	15 42	16 18	16 56	17 38	18 24	19 15	20 13	16
20	20 52	21 32	22 12	22 56	23 40	24 32	25 28	26 28	27 32	28 44	30 04	31 36	20
24	30 03	31 00	31 58	33 01	34 05	35 20	36 41	38 06	39 39	41 23	43 18	45 30	24
28	40 54	42 13	43 31	44 57	46 23	48 05	49 55	51 53	53 58	56 19	58 56	61 54	28
32	53 25	55 08	56 50	58 43	60 35	62 48	65 11	67 46	70 29	73 33	76 58	80 54	32
36	67 37	69 46	71 56	74 18	76 41	79 30	...	...	...	...	...	...	36
40	83 28	86 08	88 48	91 44	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.13	3.23	3.33	3.44	3.55	3.68	3.82	3.97	4.13	4.31	4.51	4.74	$\triangle_1 h$
Log.	0.495 54	0.509 20	0.522 44	0.536 56	0.550 23	0.565 85	0.582 06	0.598 79	0.615 95	0.634 48	0.654 18	0.675 78	Log.
Limit	34	33	32	32	32	31	30	29	28	27	26	25	Minutes
Meridian	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	1 19	1 24	1 29	1 35	1 42	1 50	2 00	2 12	2 27	2 46	3 11	3 47	4
8	5 19	5 38	5 58	6 21	6 49	7 21	8 00	8 48	9 46	11 02	12 13	15 05	8
12	11 59	12 39	13 25	14 19	15 20	16 34	18 00	19 47	21 59	24 50	28 38	33 56	12
16	21 17	22 29	23 51	25 25	27 16	29 26	32 00	35 09	39 05	44 10	...	...	16
20	33 16	35 08	37 16	39 44	42 36	46 00	50 00	54 56	...	...	...	...	20
24	47 54	50 35	53 40	57 13	61 21	66 14	...	...	...	...	...	...	24
28	65 11	68 52	73 01	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.99	5.27	5.59	5.96	6.39	6.90	7.50	8.24	9.16	10.35	11.93	14.14	$\triangle_1 h$
Log.	0.698 10	0.721 81	0.747 41	0.775 25	0.805 50	0.838 85	0.875 06	0.915 93	0.961 90	1.014 94	1.076 64	1.150 45	Log.
Limit	24	23	22	21	20	19	17	16	15	14	12	10	Minntes
Meridian	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	...	...	...	...	...	...	...	...	...	3 15	2 40	2 14	4
8	...	...	...	...	...	...	...	...	...	13 01	10 40	8 59	8
12	...	...	...	...	...	...	...	...	...	29 17	24 00	20 13	12
16	...	...	...	...	...	...	...	...	...	...	42 40	35 55	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	...	...	12.20	10.00	8.42	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.086 36	1.00 ...	0.925 31	Log.
Limit	8	6	4	2	0	2	4	6	8	10	12	14	Minutes
Meridian	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	Altitudes

Latitude 40° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 55	1 41	1 29	1 19	1 11	1 04	0 59	0 52	0 49	0 45	0 41	0 38	4
8	7 43	6 44	5 57	5 17	4 45	4 17	3 53	3 32	3 15	2 59	2 45	2 32	8
12	17 21	15 08	13 22	11 55	10 41	9 39	8 45	7 59	7 19	6 43	6 12	5 43	12
16	30 51	26 56	23 46	21 09	18 59	17 09	15 35	14 13	13 01	11 57	11 00	10 09	16
20	48 12	42 04	37 08	33 04	29 40	26 48	24 20	22 12	20 20	18 40	17 12	15 52	20
24	...	...	53 28	47 37	42 43	38 36	35 03	31 58	29 17	26 53	24 46	22 51	24
28	...	...	...	...	58 09	52 32	47 41	43 31	39 51	36 35	33 43	31 06	28
32	...	...	...	...	...	68 36	62 17	56 50	52 03	47 47	44 02	40 37	32
36	...	...	...	...	...	...	...	71 56	65 53	60 29	55 44	51 25	36
40	...	...	...	...	...	...	...	...	...	74 40	68 48	63 28	40
44	...	...	...	...	...	...	...	...	...	...	...	76 48	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	7.23	6.31	5.57	4.96	4.45	4.02	3.65	3.33	3.05	2.80	2.58	2.38	△₁h
Log.	0.859 14	0.800 03	0.745 86	0.695 48	0.648 36	0.604 23	0.562 29	0.522 44	0.484 30	0.447 16	0.411 62	0.376 58	Log.
Limit	16	18	20	21	23	25	27	28	30	32	34	36	Minutes
Meridian	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 33	0 30	0 28	0 26	0 24	0 22	0 21	0 19	0 18	0 16	0 15	4
8	2 21	2 10	2 01	1 52	1 43	1 36	1 30	1 23	1 17	1 10	1 06	1 01	8
12	5 17	4 52	4 32	4 12	3 53	3 36	3 22	3 06	2 53	2 39	2 28	2 17	12
16	9 23	8 40	8 04	7 28	6 55	6 24	5 58	5 30	5 07	4 45	4 24	4 03	16
20	14 40	13 32	12 36	11 40	10 48	10 00	9 20	8 36	8 00	7 24	6 52	6 20	20
24	21 07	19 29	18 09	16 48	15 34	14 24	13 26	12 23	11 31	10 40	9 53	9 07	24
28	28 45	26 32	24 42	22 52	21 10	19 36	18 18	16 52	15 41	14 30	13 28	12 25	28
32	37 33	34 39	32 15	29 52	27 38	25 36	23 54	22 01	20 29	18 56	17 35	16 13	32
36	47 31	43 51	40 50	37 48	34 00	32 24	30 14	27 52	25 55	23 59	22 15	20 31	36
40	58 40	54 08	50 24	46 20	43 12	40 00	37 20	34 24	32 00	29 36	27 28	25 20	40
44	70 59	65 30	60 59	56 28	52 17	48 24	45 10	41 37	38 43	35 49	33 14	30 39	44
48	...	77 57	72 34	67 10	62 12	57 36	53 46	49 32	46 05	42 37	39 33	36 29	48
52	...	...	85 10	78 52	73 00	67 36	63 06	58 08	54 05	50 01	46 25	42 49	52
56	...	...	...	...	...	78 24	73 10	67 25	62 43	58 01	53 50	49 39	56
60	...	...	...	...	...	...	...	77 24	72 00	66 36	61 48	57 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.20	2.03	1.89	1.75	1.62	1.50	1.40	1.29	1.20	1.11	1.03	0.95	△₁h
Log.	0.342 42	0.307 50	0.276 46	0.243 04	0.209 52	0.176 09	0.146 13	0.110 59	0.079 18	0.045 32	0.012 84	9.977 72	Log.
Limit	38	40	42	44	45	46	48	50	52	54	56	57	Minutes
Meridian	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	59°	Altitudes

Latitude 40° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 36	0 36	0 35	0 35	0 34	0 33	0 33	0 32	0 31	0 30	0 30	4
8	2 30	2 27	2 24	2 21	2 18	2 15	2 13	2 11	2 08	2 05	2 03	2 01	8
12	5 37	5 30	5 24	5 17	5 11	5 05	5 00	4 54	4 48	4 44	4 38	4 34	12
16	9 59	9 46	9 36	9 23	9 13	9 03	8 52	8 42	8 32	8 24	8 14	8 06	16
20	15 36	15 16	15 00	14 40	14 24	14 08	13 52	13 36	13 20	13 08	12 52	12 40	20
24	22 28	21 59	21 36	21 07	20 45	20 22	19 58	19 35	19 12	18 54	18 31	18 14	24
28	30 34	29 56	29 24	28 45	28 13	27 42	27 11	26 39	26 08	25 45	25 14	24 50	28
32	39 56	39 05	38 24	37 33	36 51	36 10	35 30	34 49	34 08	33 38	32 57	32 26	32
36	50 33	49 28	48 36	47 31	46 40	45 48	44 56	44 04	43 12	42 33	41 41	41 02	36
40	62 24	61 04	60 00	58 40	57 36	56 32	55 28	54 24	53 20	52 32	51 28	50 40	40
44	75 30	73 53	72 36	70 59	69 42	68 25	67 07	65 49	64 32	63 34	62 16	61 18	44
48	89 51	87 56	86 24	84 29	82 56	81 24	79 52	78 20	76 48	75 39	74 07	72 58	48
52	105 27	103 12	101 24	99 09	97 20	95 32	93 44	91 56	90 08	88 47	86 59	85 38	52
56	...	...	...	...	...	...	...	106 37	104 32	102 57	100 52	99 18	56
60	...	...	...	...	...	...	...	...	...	...	...	114 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.34	2.29	2.25	2.20	2.16	2.12	2.08	2.04	2.00	1.97	1.93	1.90	$\Delta_1 h$
Log.	0.369 22	0.359 84	0.352 18	0.342 42	0.334 45	0.326 34	0.318 06	0.309 63	0.301 03	0.294 47	0.285 56	0.278 75	Log.
Limit	42	42	43	43	44	45	45	46	47	48	49	49	Minutes
Meridian	50°	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 30	0 29	0 28	0 28	0 27	0 27	0 27	0 26	0 26	0 25	0 25	4
8	2 00	1 58	1 55	1 54	1 52	1 50	1 48	1 46	1 44	1 42	1 41	1 39	8
12	4 29	4 25	4 19	4 16	4 11	4 08	4 03	3 59	3 54	3 51	3 48	3 43	12
16	7 59	7 51	7 41	7 33	7 25	7 20	7 13	7 05	6 58	6 53	6 44	6 37	16
20	12 28	12 16	12 00	11 48	11 36	11 28	11 16	11 04	10 52	10 44	10 32	10 20	20
24	17 57	17 40	17 17	16 59	16 42	16 31	16 14	15 57	15 39	15 28	15 10	14 53	24
28	24 26	24 02	23 31	23 08	22 44	22 29	22 05	21 41	21 18	21 02	20 39	20 15	28
32	31 55	31 24	30 43	30 13	29 42	29 21	28 50	28 19	27 49	27 28	26 58	26 27	32
36	40 24	39 45	38 53	38 14	37 35	37 09	36 31	35 52	35 13	34 47	34 08	33 29	36
40	49 52	49 04	48 00	47 12	46 24	45 52	45 04	44 16	43 28	42 56	42 08	41 20	40
44	60 21	59 22	58 05	57 07	56 08	55 30	54 32	53 34	52 36	51 57	50 59	50 01	44
48	71 48	70 39	69 07	67 56	66 47	66 01	64 53	63 44	62 35	61 49	60 40	59 31	48
52	84 16	82 55	81 07	79 46	78 25	77 31	76 09	74 48	73 27	72 33	71 12	69 51	52
56	97 45	96 10	94 05	92 31	90 56	89 54	88 20	86 46	85 12	84 09	82 35	81 01	56
60	112 12	110 24	108 00	106 12	104 24	103 12	101 24	99 36	97 48	96 36	94 48	93 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.87	1.84	1.80	1.77	1.74	1.72	1.69	1.66	1.63	1.61	1.58	1.55	$\Delta_1 h$
Log.	0.271 84	0.264 82	0.255 27	0.247 97	0.240 55	0.235 53	0.227 89	0.220 11	0.212 19	0.206 83	0.198 66	0.190 33	Log.
Limit	50	51	51	52	52	53	54	55	56	56	57	58	Minutes
Meridian	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	Altitudes

Latitude 40° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 24	0 24	0 23	0 23	0 22	0 22	0 22	0 22	0 22	0 21	0 21	0 20	4
8	1 38	1 36	1 35	1 34	1 32	1 30	1 29	1 27	1 26	1 24	1 23	1 22	8
12	3 40	3 36	3 34	3 31	3 24 6	3 23	3 20	3 16	3 13	3 10	3 07	3 05	12
16	6 32	6 24	6 18	6 13	6 06	6 01	5 56	5 48	5 43	5 38	5 33	5 27	16
20	10 12	10 00	9 52	9 44	9 32	9 24	9 16	9 04	8 56	8 48	8 40	8 32	20
24	14 41	14 24	14 12	14 01	13 43	13 32	13 21	13 04	12 52	12 41	12 29	12 17	24
28	20 00	19 36	19 21	19 05	18 42	18 26	18 10	17 46	17 30	17 15	16 59	16 44	28
32	26 07	25 36	25 16	24 55	24 25	24 04	23 43	23 12	22 52	22 31	22 11	21 51	32
36	33 03	32 24	31 58	31 32	30 53	30 27	30 02	29 23	28 57	28 31	28 05	27 39	36
40	40 48	40 00	39 28	38 56	38 08	37 36	37 04	36 16	35 44	35 12	34 40	34 08	40
44	49 22	48 24	47 45	47 06	46 08	45 29	44 51	43 53	43 14	42 36	41 57	41 18	44
48	58 45	57 36	56 50	56 04	54 55	54 09	53 22	52 13	51 27	50 41	49 55	49 09	48
52	68 57	67 36	66 42	65 48	64 27	63 33	62 38	61 17	60 23	59 29	58 35	57 41	52
56	79 58	78 24	77 21	76 18	74 44	73 41	72 39	71 05	70 02	69 00	67 57	66 54	56
60	91 48	90 00	88 48	87 36	85 48	84 36	83 24	81 36	80 24	79 12	78 00	76 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.53	1.50	1.48	1.46	1.43	1.41	1.39	1.36	1.34	1.32	1.30	1.28	$\Delta_1 h$
Log.	0.184 69	0.176 09	0.170 26	0.164 35	0.155 34	0.149 22	0.143 01	0.133 54	0.127 10	0.120 57	0.113 94	0.107 21	Log.
Limit	59	60	60	61	62	63	64	64	65	66	67	68	Minutes
Meridian	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 20	0 19	0 19	0 19	0 19	0 18	0 18	0 17	0 17	...	...	4
8	1 21	1 20	1 17	1 16	1 15	1 13	1 12	1 11	1 10	1 08	...	...	8
12	3 02	2 59	2 54	2 51	2 48	2 45	2 42	2 39	2 37	2 34	...	...	12
16	5 22	5 17	5 10	5 05	5 00	4 55	4 50	4 45	4 39	4 34	...	...	16
20	8 24	8 16	8 04	7 56	7 48	7 40	7 32	7 24	7 16	7 08	...	...	20
24	12 06	11 54	11 37	11 26	11 14	11 03	10 51	10 40	10 28	10 16	...	...	24
28	16 28	16 12	15 49	15 33	15 17	15 01	14 46	14 30	14 15	13 59	...	...	28
32	21 30	21 10	20 39	20 18	19 58	19 37	19 17	18 56	18 36	18 16	...	...	32
36	27 13	26 47	26 08	25 43	25 17	24 51	24 25	23 59	23 33	23 07	...	...	36
40	33 36	33 04	32 16	31 44	31 12	30 40	30 08	29 36	29 04	28 32	...	...	40
44	40 38	40 00	39 02	38 24	37 46	37 07	36 28	35 49	35 10	34 32	...	...	44
48	48 23	47 37	46 28	45 41	44 55	44 09	43 23	42 37	41 51	41 05	...	...	48
52	56 47	55 53	54 32	53 37	52 43	51 49	50 55	50 01	49 07	48 13	...	...	52
56	65 51	64 48	63 14	62 12	61 10	60 07	59 04	58 01	56 58	55 56	...	...	56
60	75 36	74 24	72 36	71 24	70 12	69 00	67 48	66 36	65 24	64 12	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.26	1.24	1.21	1.19	1.17	1.15	1.13	1.11	1.09	1.07	...	...	$\Delta_1 h$
Log.	0.100 37	0.093 42	0.082 79	0.075 55	0.068 19	0.060 70	0.053 08	0.045 32	0.037 43	0.029 38	... ...	... ...	Log.
Limit	69	70	71	72	74	75	76	77	78	78			Minutes
Meridian	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	0 14	0 13	0 13	0 13	0 12	4
8	...	...	...	...	...	...	...	0 55	0 54	0 52	0 51	0 50	8
12	...	...	...	...	...	...	...	2 05	2 01	1 58	1 55	1 52	12
16	...	...	...	...	...	...	...	3 43	3 35	3 30	3 25	3 19	16
20	...	...	...	...	...	...	...	5 48	5 36	5 28	5 20	5 12	20
24	...	...	...	...	...	...	...	8 21	8 04	7 53	7 41	7 29	24
28	...	...	...	...	...	...	...	11 22	10 58	10 43	10 27	10 12	28
32	...	...	...	...	...	...	...	14 51	14 20	13 59	13 39	13 19	32
36	...	...	...	...	...	...	...	18 48	18 09	17 43	17 17	16 51	36
40	...	...	...	...	...	...	...	23 12	22 24	21 52	21 20	20 48	40
44	...	...	...	...	...	...	...	28 05	27 06	26 28	25 49	25 10	44
48	...	...	...	...	...	...	...	33 24	32 15	31 29	30 43	29 55	48
52	...	...	...	...	...	...	...	39 12	37 51	36 57	36 03	35 09	52
56	...	...	...	...	...	...	...	45 29	43 54	42 52	41 49	40 46	56
60	...	...	...	...	...	...	...	52 12	50 24	49 12	48 00	46 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	...	...	...	0.87	0.84	0.82	0.80	0.78	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.939 52	9.924 28	9.913 81	9.903 09	9.892 09	Log.
Limit								77	77	78	79	81	Minutes
Meridian	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 11	0 11	0 11	0 11	0 11	0 10	0 09	0 09	0 09	0 09	4
8	0 50	0 48	0 46	0 45	0 43	0 42	0 40	0 39	0 38	0 37	0 35	0 34	8
12	1 51	1 48	1 44	1 41	1 37	1 35	1 32	1 27	1 25	1 22	1 19	1 16	12
16	3 17	3 12	3 04	2 59	2 54	2 49	2 44	2 37	2 31	2 26	2 21	2 16	16
20	5 08	5 00	4 48	4 40	4 32	4 24	4 16	4 04	3 56	3 48	3 40	3 32	20
24	7 23	7 12	6 55	6 43	6 32	6 21	6 09	5 52	5 40	5 28	5 17	5 05	24
28	10 04	9 48	9 25	9 09	8 53	8 37	8 21	7 58	7 43	7 27	7 11	6 56	28
32	13 09	12 48	12 17	11 57	11 36	11 15	10 55	10 24	10 04	9 44	9 23	9 03	32
36	16 38	16 12	15 33	15 07	14 42	14 16	13 50	13 11	12 45	12 18	11 53	11 27	36
40	20 32	20 00	19 12	18 40	18 08	17 36	17 04	16 16	15 44	15 12	14 40	14 08	40
44	24 51	24 12	23 14	22 35	21 57	21 18	20 39	19 41	19 02	18 24	17 45	17 06	44
48	29 32	28 46	27 37	26 51	26 08	25 20	24 34	23 25	22 39	21 54	21 07	20 21	48
52	34 42	33 48	32 27	31 33	30 38	29 44	28 50	27 29	26 35	25 41	24 47	23 53	52
56	40 15	39 12	37 38	36 35	35 33	34 30	33 27	31 53	30 50	29 48	28 45	27 42	56
60	46 12	45 00	43 12	42 00	40 48	39 36	38 24	36 36	35 24	34 12	33 00	31 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.77	0.75	0.73	0.70	0.68	0.66	0.64	0.61	0.59	0.57	0.55	0.53	$\triangle_1$h
Log.	9.886 49	9.875 06	9.863 32	9.845 10	9.832 51	9.819 54	9.806 18	9.785 33	9.770 85	9.755 87	9.740 36	9.724 28	Log.
Limit	82	82	82	83	83	84	84	85	85	86	86	87	Minutes
Meridian	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 36	0 37	0 38	0 38	0 39	0 40	0 41	0 42	0 43	0 44	0 45	0 46	4
8	2 25	2 28	2 30	2 34	2 38	2 41	2 45	2 48	2 52	2 57	3 01	3 06	8
12	5 26	5 32	5 38	5 46	5 55	6 01	6 10	6 18	6 27	6 38	6 47	6 59	12
16	9 38	9 52	10 02	10 14	10 29	10 43	10 58	11 14	11 29	11 46	12 05	12 25	16
20	15 04	15 24	15 40	16 00	16 24	16 44	17 08	17 32	17 56	18 24	18 52	19 24	20
24	21 42	22 11	22 34	23 02	23 37	24 06	24 40	25 15	25 50	26 30	27 10	27 56	24
28	29 32	30 11	30 42	31 22	32 09	32 48	33 35	34 22	35 09	36 04	36 59	38 02	28
32	38 34	39 25	40 06	40 58	41 59	42 50	43 52	44 53	45 54	47 06	48 18	49 40	32
36	48 49	49 54	50 46	51 50	53 08	54 13	55 31	56 49	58 07	59 37	61 08	62 51	36
40	60 16	61 36	62 40	64 00	65 36	66 56	68 32	70 08	71 44	73 36	75 28	77 36	40
44	72 55	74 32	75 50	77 26	79 22	80 59	82 56	84 52	86 48	...	...	...	44
48	86 47	88 42	90 14	92 10	94 28	96 33	...	...	...	...	...	...	48
52	101 51	104 06	105 54	108 10	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.26	2.31	2.35	2.40	2.46	2.51	2.57	2.63	2.69	2.76	2.83	2.91	$\Delta_1 h$
Log.	0.354 11	0.363 61	0.371 07	0.380 21	0.390 94	0.399 67	0.409 93	0.419 96	0.429 75	0.440 91	0.451 79	0.463 89	Log.
Limit	43	42	41	41	40	40	39	38	38	37	37	36	Minutes
Meridian	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 47	0 49	0 51	0 52	0 54	0 55	0 58	1 00	1 02	1 05	1 07	1 10	4
8	3 11	3 17	3 23	3 30	3 36	3 43	3 51	4 00	4 09	4 19	4 30	4 43	8
12	7 11	7 24	7 36	7 51	8 05	8 22	8 39	8 59	9 20	9 42	10 08	10 35	12
16	12 45	13 08	13 32	13 57	14 23	14 50	15 25	15 57	16 36	17 14	18 00	18 49	16
20	19 56	20 32	21 08	21 48	22 28	23 12	24 04	24 56	25 56	26 56	28 08	29 24	20
24	28 42	29 34	30 26	31 23	32 21	33 24	34 40	35 54	37 21	68 47	40 31	42 20	24
28	39 05	40 15	41 25	42 44	44 02	45 29	47 10	48 52	50 50	52 47	55 09	57 38	28
32	51 02	52 34	54 06	55 49	57 31	59 24	61 36	63 50	66 23	68 57	72 01	75 16	32
36	64 35	66 32	68 29	70 38	72 48	75 10	77 59	...	...	...	...	...	36
40	79 44	82 08	84 32	87 12	89 52	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.99	3.08	3.17	3.27	3.37	3.48	3.61	3.74	3.89	4.04	4.22	4.41	$\Delta_1 h$
Log	0.475 67	0.488 55	0.501 06	0.514 55	0.527 63	0.541 58	0.557 51	0.572 87	0.589 95	0.606 38	0.625 31	0.644 44	Log.
Limit	35	34	33	33	32	31	30	29	29	28	27	26	Minutes
Meridian	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	Altitudes

Latitude 41° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 15	1 18	1 23	1 27	1 33	1 40	1 48	1 57	2 08	2 22	2 41	3 06	4
8	4 56	5 12	5 30	5 50	6 12	6 39	7 11	7 48	8 34	9 31	10 45	12 23	8
12	11 06	11 41	12 21	13 07	13 58	14 57	16 09	17 32	19 14	21 26	24 12	27 51	12
16	19 46	20 47	21 59	23 17	24 50	26 35	28 43	31 12	34 16	38 06	43 00	...	16
20	30 52	32 28	34 20	36 24	38 48	41 32	44 52	48 44	53 32	...	...	...	20
24	44 27	46 45	49 27	52 25	55 53	59 48	64 36	...	...	...	...	...	24
28	60 30	63 38	67 17	...	...	...	...	...	...	...	...	...	28
32	79 01	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.63	4.87	5.15	5.46	5.82	6.23	6.73	7.31	8.03	8.93	10.08	11.61	$\triangle_1 h$
Log.	0.665 58	0.687 53	0.711 81	0.737 19	0.764 92	0.794 49	0.828 02	0.863 92	0.904 72	0.950 85	1.003 46	1.064 83	Log.
Limit	25	24	23	22	21	20	18	17	16	15	14	13	Minutes
Meridian	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	...	...	3 09	2 35	4
8	...	...	...	...	...	...	...	...	...	...	12 35	10 19	8
12	...	...	...	...	...	...	...	...	...	...	28 19	23 12	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	13.75	...	...	...	...	...	...	...	...	...	11.80	9.67	$\triangle_1 h$
Log.	1.138 30	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.071 88	0.985 43	Log.
Limit	10	8	6	4	2	0	2	4	6	9	11	13	Minutes
Meridian	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	Altitudes

Latitude 41° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 10	1 51	1 37	1 26	1 16	1 08	1 02	0 56	0 51	0 47	0 43	0 39	4
8	8 41	7 26	6 30	5 44	5 06	4 35	4 08	3 45	3 25	3 07	2 51	2 39	8
12	19 32	16 46	14 37	12 53	11 29	10 18	9 17	8 25	7 41	7 02	6 26	5 56	12
16	34 44	29 46	25 59	22 55	20 23	18 18	16 31	14 59	13 39	12 30	11 26	10 32	16
20	54 16	46 32	40 36	35 48	31 52	28 36	25 48	23 24	21 20	19 32	17 52	16 28	20
24	...	...	58 28	51 33	45 53	41 11	37 09	33 42	30 43	28 07	25 44	23 42	24
28	...	...	...	...	...	56 04	50 34	45 52	41 49	38 18	35 01	32 17	28
32	...	...	...	...	...	...	66 03	59 54	54 37	50 01	45 44	42 10	32
36	...	...	...	...	...	...	...	...	69 07	63 17	57 54	53 21	36
40	...	...	...	...	...	...	...	...	...	...	71 28	65 52	40
44	...	...	...	...	...	...	...	...	...	...	...	79 42	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	8.14	6.98	6.09	5.37	4.78	4.29	3 87	3.51	3.20	2.93	2.68	2.47	$\triangle_1$h
Log.	0.910 62	0.843 86	0.784 62	0.729 97	0.679 43	0.632 46	0.587 71	0.545 31	0.505 15	0.466 87	0.428 13	0.392 70	Log.
Limit	15	17	19	20	22	24	26	27	29	31	32	34	Minutes
Meridian	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 37	0 34	0 31	0 29	0 27	0 25	0 23	0 21	0 19	0 18	0 17	0 15	4
8	2 26	2 14	2 04	1 55	1 46	1 39	1 32	1 24	1 18	1 12	1 07	1 01	8
12	5 29	5 02	4 40	4 19	3 59	3 42	3 24	3 10	2 56	2 42	2 30	2 17	12
16	9 43	8 58	8 16	7 41	7 05	6 34	6 06	5 38	5 12	4 50	4 26	4 03	16
20	15 12	14 00	12 56	12 00	11 04	10 16	9 32	8 48	8 08	7 32	6 56	6 20	20
24	21 53	20 10	18 37	17 17	15 57	14 47	13 43	12 41	11 43	10 51	9 59	9 07	24
28	29 48	27 26	25 21	23 31	21 41	20 07	18 42	17 15	15 57	14 46	13 35	12 25	28
32	38 55	35 50	33 07	30 43	28 19	26 17	24 25	22 31	20 49	19 17	17 45	16 13	32
36	49 15	45 22	41 54	38 53	35 52	33 16	30 53	28 31	26 21	24 25	22 28	20 31	36
40	60 48	56 00	51 44	48 00	44 16	41 04	38 08	35 12	32 32	30 08	27 44	25 20	40
44	73 34	67 46	62 35	58 05	53 34	49 41	46 08	42 36	39 22	36 28	33 33	30 39	44
48	...	...	74 30	69 07	63 44	59 08	54 55	50 41	46 51	43 23	39 56	36 29	48
52	...	...	...	81 07	74 48	69 24	64 27	59 29	54 59	50 55	46 52	42 49	52
56	...	...	...	...	...	80 29	74 44	69 00	63 46	59 04	54 21	49 39	56
60	...	...	...	...	...	...	...	79 12	73 12	67 48	62 24	57 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.28	2.10	1.94	1.80	1.66	1.54	1.43	1.32	1.22	1.13	1.04	0.95	$\triangle_1$h
Log.	0.357 93	0.322 22	0.287 80	0.255 27	0.220 11	0.187 52	0.155 34	0.120 57	0.086 36	0.053 08	0.017 03	9.977 72	Log.
Limit	36	38	40	42	44	45	47	49	51	53	56	59	Minutes
Meridian	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	60°	Altitudes

Latitude 41° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 36	0 35	0 35	0 34	0 33	0 33	0 32	0 31	0 31	0 30	0 30	0 30	4
8	2 25	2 22	2 19	2 16	2 14	2 11	2 09	2 06	2 04	2 02	2 00	1 58	8
12	5 26	5 18	5 12	5 06	5 01	4 55	4 51	4 46	4 40	4 35	4 31	4 26	12
16	9 38	9 26	9 16	9 06	8 55	8 45	8 37	8 26	8 16	8 09	8 01	7 54	16
20	15 04	14 44	14 28	14 12	13 56	13 40	13 28	13 12	12 56	12 44	12 32	12 20	20
24	21 42	21 13	20 50	20 27	20 04	19 41	19 24	19 00	18 37	18 20	18 03	17 46	24
28	29 32	28 53	28 21	27 50	27 19	26 47	26 24	25 53	25 21	24 58	24 34	24 10	28
32	38 34	37 43	37 02	36 21	35 40	34 59	34 28	33 48	33 07	32 36	32 05	31 34	32
36	48 49	47 44	46 53	46 01	45 09	44 17	43 38	42 46	41 54	41 15	40 37	39 58	36
40	60 16	58 56	57 52	56 48	55 44	54 40	53 52	52 48	51 44	50 56	50 08	49 20	40
44	72 55	71 18	70 02	68 44	67 26	66 09	65 11	63 53	62 35	61 37	60 40	59 42	44
48	86 47	84 52	83 19	81 46	80 15	78 43	77 34	76 02	74 30	73 21	72 11	71 02	48
52	101 51	99 36	97 47	95 59	94 11	92 23	91 02	89 14	87 26	86 05	84 43	83 22	52
56	...	...	...	...	...	...	105 35	103 29	101 23	99 49	98 15	96 42	56
60	...	...	...	...	...	...	...	...	...	114 36	112 48	111 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.26	2.21	2.17	2.13	2.09	2.05	2.02	1.98	1.94	1.91	1.88	1.85	△₁h
Log.	0.354 11	0.344 39	0.336 46	0.328 38	0.320 15	0.311 75	0.305 35	0.296 67	0.287 80	0.281 03	0.274 16	0.267 17	Log.
Limit	43	43	44	44	45	46	46	47	47	48	49	49	Minutes
Meridian	49°	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 29	0 28	0 28	0 27	0 27	0 27	0 27	0 26	0 25	0 25	0 25	0 24	4
8	1 56	1 54	1 53	1 51	1 49	1 47	1 45	1 43	1 42	1 41	1 39	1 37	8
12	4 20	4 17	4 14	4 09	4 05	4 00	3 56	3 53	3 49	3 46	3 42	3 39	12
16	7 44	7 35	7 30	7 23	7 15	7 08	7 00	6 55	6 47	6 42	6 34	6 29	16
20	12 04	11 52	11 44	11 32	11 20	11 08	10 56	10 48	10 36	10 28	10 16	10 08	20
24	17 23	17 05	16 54	16 36	16 19	16 02	15 45	15 34	15 16	15 04	14 47	14 36	24
28	23 39	23 16	23 00	22 37	22 13	21 49	21 25	21 10	20 47	20 31	20 07	19 52	28
32	30 53	30 23	30 02	29 32	29 01	28 30	27 59	27 38	27 08	26 48	26 17	25 56	32
36	39 06	38 27	38 01	37 22	36 43	36 05	35 26	35 00	34 21	33 55	33 16	32 50	36
40	48 16	47 28	46 56	46 08	45 20	44 32	43 44	43 12	42 24	41 52	41 04	40 32	40
44	58 24	57 26	56 47	55 49	54 51	53 54	52 55	52 17	51 18	50 40	49 41	49 03	44
48	69 30	68 19	67 33	66 24	65 15	64 07	62 58	62 12	61 03	60 17	59 08	58 22	48
52	81 34	80 13	79 19	77 58	76 37	75 15	73 54	73 00	71 39	70 45	69 24	68 30	52
56	94 36	93 02	91 59	90 25	88 51	87 18	85 43	84 41	83 06	82 04	80 29	79 27	56
60	108 36	106 48	105 36	103 48	102 00	100 12	98 24	97 12	95 24	94 12	92 24	91 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.81	1.78	1.76	1.73	1.70	1.67	1.64	1.62	1.59	1.57	1.54	1.52	△₁h
Log.	0.257 68	0.250 42	0.245 51	0 238 05	0.230 45	0.222 72	0.214 84	0.209 52	0.201 40	0.195 90	0.187 52	0.181 84	Log.
Limit	50	51	52	53	53	54	55	56	57	57	58	59	Minutes
Meridian	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	Altitudes

Latitude 41° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 23	0 23	0 22	0 22	0 22	0 22	0 22	0 21	0 20	0 20	0 20	4
8	1 36	1 34	1 33	1 31	1 30	1 28	1 27	1 25	1 24	1 23	1 22	1 20	8
12	3 35	3 31	3 28	3 25	3 22	3 19	3 16	3 11	3 08	3 06	3 03	3 00	12
16	6 21	6 13	6 08	6 03	5 58	5 53	5 48	5 41	5 36	5 30	5 25	5 20	16
20	9 56	9 44	9 36	9 28	9 20	9 12	9 04	8 52	8 44	8 36	8 28	8 20	20
24	14 18	14 01	13 49	13 38	13 26	13 15	13 04	12 46	12 35	12 23	12 11	12 00	24
28	19 29	19 05	18 49	18 34	18 18	18 02	17 46	17 23	17 07	16 52	16 36	16 20	28
32	25 26	24 55	24 35	24 14	23 54	23 33	23 12	22 42	22 21	22 01	21 41	21 20	32
36	32 11	31 32	31 06	30 40	30 14	29 49	29 23	28 44	28 18	27 52	27 26	27 00	36
40	39 44	38 56	38 24	37 52	37 20	36 48	36 16	35 28	34 56	34 24	33 52	33 20	40
44	48 04	47 06	46 27	45 49	45 10	43 32	43 53	42 55	42 16	41 37	40 59	40 20	44
48	57 13	56 04	55 18	54 32	53 46	52 59	52 13	51 04	50 18	49 32	48 45	48 00	48
52	67 09	65 48	64 54	64 00	63 06	62 11	61 17	59 56	59 02	58 08	57 14	56 20	52
56	77 52	76 18	75 15	74 13	73 10	72 08	71 05	69 31	68 28	67 25	66 23	65 20	56
60	89 24	87 36	86 24	85 12	84 00	82 48	81 36	79 48	78 36	77 24	76 12	75 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△$_1$h	1.49	1.46	1.44	1.42	1.40	1.38	1.36	1.33	1.31	1.29	1.27	1.25	△$_1$h
Log.	0.173 19	0.164 35	0.158 36	0.152 29	0.146 13	0.139 88	0.133 54	0.123 85	0.117 27	0.110 59	0.103 80	0.096 91	Log.
Limit	60	61	61	62	63	64	65	65	66	67	68	69	Minutes
Meridian	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 19	0 19	0 19	0 19	0 19	0 18	0 17	0 17	...	...	...	4
8	1 19	1 18	1 16	1 15	1 13	1 12	1 11	1 10	1 09	...	...	...	8
12	2 57	2 54	2 51	2 48	2 45	2 42	2 39	2 37	2 34	...	...	...	12
16	5 15	5 10	5 05	5 00	4 55	4 50	4 45	4 39	4 34	...	...	...	16
20	8 12	8 04	7 56	7 48	7 40	7 32	7 24	7 16	7 08	...	...	...	20
24	11 48	11 37	11 26	11 14	11 03	10 51	10 40	10 28	10 16	...	...	...	24
28	16 05	15 49	15 33	15 17	15 01	14 46	14 30	14 15	13 59	...	...	...	28
32	21 00	20 39	20 18	19 58	19 37	19 17	18 56	18 36	18 16	...	...	...	32
36	26 34	26 08	25 43	25 17	24 51	24 25	23 59	23 33	23 07	...	...	...	36
40	32 48	32 16	31 44	31 12	30 40	30 08	29 36	29 04	28 32	...	...	...	40
44	39 41	39 02	38 24	37 46	37 07	36 28	35 49	35 10	34 32	...	...	...	44
48	47 14	46 28	45 41	44 55	44 09	43 23	42 37	41 51	41 05	...	...	...	48
52	55 26	54 32	53 37	52 43	51 49	50 55	50 01	49 07	48 13	...	...	...	52
56	64 17	63 14	62 12	61 10	60 07	59 04	58 01	56 58	55 56	...	...	...	56
60	73 48	72 36	71 24	70 12	69 00	67 48	66 36	65 28	64 12	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△$_1$h	1.23	1.21	1.19	1.17	1.15	1.13	1.11	1.09	1.07	...	...	...	△$_1$h
Log.	0.089 91	0.082 79	0.075 55	0.068 19	0.060 70	0.053 08	0.045 32	0.037 43	0.029 38	... ...	... ...	... ...	Log.
Limit	70	71	72	73	75	76	77	78	78				Minutes
Meridian	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	0 14	0 14	0 14	0 13	0 12	0 12	4
8	...	...	...	...	...	...	0 56	0 54	0 53	0 52	0 51	0 50	8
12	...	...	...	...	...	...	2 07	2 02	1 59	1 56	1 54	1 53	12
16	...	...	...	...	...	...	3 45	3 38	3 33	3 28	3 22	3 19	16
20	...	...	...	...	...	...	5 52	5 40	5 32	5 24	5 16	5 12	20
24	...	...	...	...	...	...	8 27	8 10	7 58	7 47	7 35	7 29	24
28	...	...	...	...	...	...	11 30	11 06	10 51	10 35	10 20	10 12	28
32	...	...	...	...	...	...	15 01	14 30	14 10	13 49	13 29	13 19	32
36	...	...	...	...	...	...	19 01	18 22	17 56	17 30	17 04	16 51	36
40	...	...	...	...	...	...	23 28	22 40	22 08	21 36	21 04	20 48	40
44	...	...	...	...	...	...	28 24	27 26	26 47	26 08	25 29	25 10	44
48	...	...	...	...	...	...	33 47	32 38	31 52	31 06	30 18	29 55	48
52	...	...	...	...	...	...	39 39	38 18	37 24	36 30	35 36	35 09	52
56	...	...	...	...	...	...	46 00	44 26	43 23	42 20	41 17	40 46	56
60	...	...	...	...	...	...	52 48	51 00	49 48	48 36	47 24	46 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	...	...	...	0.88	0.85	0.83	0.81	0.79	0.78	$\Delta_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	9.944 48	9.929 42	9.919 08	9.908 49	9.897 63	9.892 09	Log.
Limit							73	74	76	77	79	80	Minutes
Meridian	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	0 08	4
8	0 49	0 48	0 46	0 44	0 43	0 41	0 40	0 38	0 37	0 36	0 35	0 33	8
12	1 50	1 47	1 42	1 39	1 36	1 33	1 30	1 26	1 24	1 21	1 18	1 15	12
16	3 14	3 09	3 02	2 57	2 52	2 47	2 42	2 34	2 28	2 23	2 18	2 13	16
20	5 04	4 56	4 44	4 36	4 28	4 20	4 12	4 00	3 52	3 44	3 36	3 28	20
24	7 18	7 06	6 49	6 38	6 26	6 15	6 03	5 46	5 34	5 23	5 11	5 00	24
28	9 56	9 40	9 17	9 01	8 45	8 29	8 14	7 50	7 35	7 19	7 03	6 48	28
32	12 58	12 38	12 07	11 46	11 26	11 05	10 45	10 14	9 54	9 53	9 13	8 52	32
36	16 25	15 59	15 20	14 55	14 29	14 03	13 37	12 58	12 32	12 06	11 40	11 14	36
40	20 16	19 44	18 56	18 24	17 52	17 20	16 48	16 00	15 28	14 56	14 24	13 52	40
44	24 31	23 52	22 54	22 16	21 38	20 59	20 20	19 22	18 43	18 04	17 25	16 47	44
48	29 09	28 23	27 14	26 29	25 43	24 57	24 11	23 02	22 16	21 30	20 44	19 58	48
52	34 15	33 21	32 00	31 05	30 11	29 17	28 23	27 02	26 08	25 14	24 20	23 26	52
56	39 44	38 40	37 06	36 04	35 02	33 59	32 56	31 22	30 19	29 16	28 13	27 11	56
60	45 36	44 24	42 36	41 24	40 12	39 00	37 48	36 00	34 48	33 36	32 24	31 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.76	0.74	0.71	0.69	0.67	0.65	0.63	0.60	0.58	0.56	0.54	0.52	$\Delta_1 h$
Log.	9.880 81	9.869 23	9.851 26	9.838 85	9.826 07	9.812 91	9.799 34	9.778 15	9.763 43	9.748 19	9.732 39	9.716 00	Log.
Limit	81	82	82	83	83	83	84	84	85	85	86	86	Minutes
Meridian	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	Altitudes

Latitude 42° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 35	0 36	0 37	0 38	0 38	0 39	0 40	0 41	0 43	0 43	0 44	4
8	2 19	2 22	2 26	2 28	2 31	2 35	2 39	2 42	2 45	2 49	2 54	2 58	8
12	5 14	5 20	5 27	5 34	5 40	5 49	5 56	6 04	6 12	6 21	6 30	6 41	12
16	9 18	9 28	9 41	9 54	10 04	10 19	10 32	10 48	11 00	11 19	11 34	11 51	16
20	14 32	14 48	15 08	15 28	15 44	16 08	16 28	16 52	17 12	17 40	18 04	18 32	20
24	20 56	21 19	21 47	22 17	22 40	23 14	23 42	24 17	24 46	25 27	26 01	26 41	24
28	28 29	29 01	29 40	30 19	30 50	31 38	32 17	33 04	33 43	34 37	35 25	36 20	28
32	37 12	37 53	38 45	39 35	40 16	41 18	42 10	43 11	44 02	45 13	46 15	47 27	32
36	47 06	47 57	49 02	50 07	50 59	52 16	53 21	54 39	55 44	57 15	58 32	60 03	36
40	58 08	59 12	60 32	61 52	62 56	64 32	65 52	67 28	68 48	70 40	72 16	74 08	40
44	70 21	71 38	73 15	74 52	76 09	78 05	79 42	81 38	83 15	85 31	87 26	...	44
48	83 42	85 15	87 10	89 05	90 37	92 56	94 51	...	...	...	...	...	48
52	98 14	100 03	102 18	104 33	106 21	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.18	2.22	2.27	2.32	2.36	2.42	2.47	2.53	2.58	2.65	2.71	2.78	△₁h
Log	0.338 46	0.346 35	0.356 03	0.365 49	0.372 91	0.383 82	0.392 70	0.403 12	0.411 62	0.423 25	0.432 97	0.444 04	Log.
Limit	44	43	42	42	41	41	40	40	39	39	38	37	Minutes
Meridian	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 46	0 46	0 48	0 50	0 51	0 53	0 54	0 56	0 59	1 01	1 03	1 06	4
8	3 02	3 07	3 13	3 18	3 25	3 31	3 39	3 46	3 54	4 03	4 13	4 24	8
12	6 50	7 02	7 15	7 26	7 41	7 55	8 11	8 28	8 47	9 07	9 31	9 54	12
16	12 10	12 30	12 53	13 14	13 39	14 05	14 33	15 04	15 37	16 13	16 53	17 38	16
20	19 00	19 32	20 08	20 40	21 20	22 00	22 44	23 32	24 24	25 20	26 24	27 32	20
24	27 22	28 07	29 00	29 46	30 43	31 41	32 44	33 53	35 09	36 29	38 01	39 39	24
28	37 14	38 18	39 28	40 30	41 49	43 07	44 34	46 08	47 49	49 39	51 45	53 58	28
32	48 38	50 01	51 32	52 54	54 37	56 19	58 12	60 15	62 27	64 51	67 35	70 29	32
36	61 34	63 17	65 14	66 58	69 07	71 17	73 39	76 15	79 04	...	...	...	36
40	76 00	78 08	80 32	82 40	85 20	88 00	90 56	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.85	2.93	3.02	3.10	3.20	3.30	3.41	3.53	3.66	3.80	3.96	4.13	△₁h
Log.	0.454 84	0.466 87	0.480 01	0.491 36	0.505 15	0.518 51	0.532 75	0.547 77	0.563 48	0.579 78	0.597 70	0.615 95	Log.
Limit	36	35	34	34	34	33	32	31	31	29	28	27	Minutes
Meridian	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Altitudes

Latitude 42° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 10	1 12	1 16	1 20	1 26	1 31	1 37	1 45	1 54	2 05	2 19	2 37	4
8	4 36	4 49	5 05	5 21	5 41	6 03	6 29	7 00	7 36	8 20	9 16	10 28	8
12	10 20	10 51	11 26	12 03	12 47	13 36	14 36	15 45	17 06	18 46	20 51	23 32	12
16	18 24	19 17	20 18	21 25	22 45	24 12	25 56	27 59	30 26	33 22	37 05	41 52	16
20	28 44	30 08	31 44	33 28	35 32	37 38	40 32	43 44	47 32	52 08	57 56	...	20
24	41 23	43 24	45 42	48 12	51 10	54 26	58 22	...	...	...	...	...	24
28	56 19	59 04	62 10	65 36	69 39	74 05	...	...	...	...	...	...	28
32	73 33	77 08	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	4.31	4.52	4.76	5.02	5.33	5.67	6.08	6.56	7.13	7.82	8.69	9.81	$\Delta_1 h$
Log.	0.634 48	0.655 14	0.677 61	0.700 70	0.726 73	0.753 58	0.783 90	0.816 90	0.853 09	0.893 21	0.939 02	0.991 67	Log.
Limit	26	25	24	23	22	21	20	18	17	16	15	14	Minutes
Meridian	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	Altitudes

37

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	3 00	3 34	...	...	...	...	...	...	...	...	...	3 02	4
8	12 03	14 16	...	...	...	...	...	...	...	...	...	12 11	8
12	27 06	32 05	...	...	...	...	...	...	...	...	...	27 23	12
16	...	...	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	11.29	13.37	...	...	...	...	...	...	...	...	...	11.41	$\Delta_1 h$
Log.	1.052 69	1.126 13	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	1.057 29	Log.
Limit	12	10	8	6	4	2	0	2	4	6	8	10	Minutes
Meridian	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	Altitudes

Latitude 42° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 29	2 06	1 48	1 34	1 23	1 14	1 06	0 59	0 54	0 49	0 45	0 41	4
8	9 58	8 22	7 12	6 16	5 31	4 54	4 23	3 58	3 36	3 17	2 59	2 45	8
12	22 25	18 50	16 11	14 05	12 24	11 02	9 53	8 56	8 05	7 22	6 43	6 12	12
16	39 51	33 30	28 45	25 03	22 04	19 38	17 35	15 52	14 23	13 06	11 57	11 00	16
20	...	52 20	44 56	39 08	34 28	30 40	27 28	24 48	22 28	20 28	18 40	17 12	20
24	...	...	...	56 21	49 38	44 10	39 34	35 43	32 21	29 28	26 53	24 46	24
28	...	...	...	...	...	60 06	53 50	48 37	44 02	40 07	36 35	33 43	28
32	...	...	...	...	...	...	...	63 29	57 31	52 24	47 47	44 03	32
36	...	...	...	...	...	...	...	...	72 48	66 19	60 29	55 44	36
40	...	...	...	...	...	...	...	...	...	...	74 40	68 48	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	9.34	7.85	6.74	5.87	5.17	4.60	4.12	3.72	3.37	3.07	2.80	2.58	$\triangle_1$h
Log.	0.970 35	0.894 87	0.828 66	0.768 64	0.713 49	0.662 76	0.614 90	0.570 54	0.527 63	0.487 14	0.447 16	0.411 62	Log.
Limit	13	15	17	19	21	23	24	26	28	30	32	34	Minutes
Meridian	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 35	0 32	0 30	0 27	0 25	0 23	0 22	0 20	0 19	0 17	0 15	4
8	2 31	2 19	2 08	1 58	1 50	1 41	1 34	1 26	1 20	1 13	1 08	1 02	8
12	5 40	5 12	4 48	4 26	4 06	3 48	3 31	3 14	3 00	2 45	2 33	2 20	12
16	10 04	9 16	8 32	7 54	7 18	6 44	6 13	5 46	5 20	4 55	4 31	4 08	16
20	15 44	14 28	13 20	12 20	11 24	10 32	9 44	9 00	8 20	7 40	7 04	6 28	20
24	22 40	20 50	19 12	17 46	16 25	15 10	14 01	12 58	12 00	11 03	10 11	9 18	24
28	30 50	28 21	26 08	24 10	22 21	20 39	19 05	17 38	16 20	15 01	13 51	12 41	28
32	40 16	37 02	34 08	31 34	29 11	26 58	24 55	23 02	21 20	19 37	18 05	16 34	32
36	50 59	46 53	43 12	39 58	36 56	34 08	31 32	29 10	27 00	24 51	22 54	20 57	36
40	62 56	57 52	53 20	49 20	45 36	42 08	38 56	36 00	33 20	30 40	28 16	25 52	40
44	...	70 02	64 32	59 42	55 10	50 59	47 06	43 34	40 20	37 07	34 12	31 18	44
48	...	...	76 48	71 02	65 38	60 40	56 04	51 50	48 00	44 09	40 42	37 15	48
52	...	...	...	...	77 04	71 12	65 48	60 50	56 20	51 49	47 46	43 43	52
56	...	...	...	...	...	...	76 18	70 34	65 20	60 07	55 24	50 42	56
60	...	...	...	...	...	...	...	81 00	75 00	69 00	63 36	58 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.36	2.17	2.00	1.85	1.71	1.58	1.46	1.35	1.25	1.15	1.06	0.97	$\triangle_1$h
Log.	0.372 91	0.336 46	0.301 03	0.267 17	0.233 00	0.198 66	0.164 35	0.130 33	0.096 91	0.060 70	0.025 31	9.986 77	Log.
Limit	35	37	39	41	43	44	46	48	50	52	55	58	Minutes
Meridian	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	61°	Altitudes

Latitude 42° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 35	0 34	0 33	0 32	0 31	0 31	0 30	0 30	0 30	0 29	0 28	4
8	2 19	2 17	2 14	2 12	2 09	2 07	2 04	2 02	2 01	1 58	1 56	1 55	8
12	5 14	5 08	5 02	4 57	4 51	4 47	4 41	4 37	4 32	4 26	4 22	4 18	12
16	9 18	9 08	8 58	8 47	8 37	8 29	8 19	8 11	8 04	7 54	7 46	7 38	16
20	14 32	14 16	14 00	13 44	13 28	13 16	13 00	12 48	12 36	12 20	12 08	11 56	20
24	20 56	20 33	20 10	19 47	19 24	19 06	18 43	18 26	18 09	17 46	17 29	17 11	24
28	28 29	27 57	27 26	26 55	26 24	26 01	25 29	25 06	24 42	24 10	23 47	23 24	28
32	37 12	36 31	35 50	35 09	34 28	33 58	33 17	32 46	32 15	31 34	31 03	30 33	32
36	47 06	46 14	45 22	44 30	43 38	42 59	42 07	41 28	40 50	39 58	39 19	38 40	36
40	58 08	57 04	56 00	54 56	53 52	53 04	52 00	51 12	50 24	49 20	48 32	47 44	40
44	70 21	69 03	67 46	66 28	65 11	64 12	62 55	61 57	60 59	59 42	58 44	57 45	44
48	83 42	82 10	80 38	79 06	77 34	76 25	74 53	73 44	72 34	71 02	69 53	68 42	48
52	98 14	96 26	94 38	92 50	91 02	89 41	87 53	86 32	85 10	83 22	82 01	80 40	52
56	. . .	. . .	. . .	. . .	105 35	104 01	101 55	100 21	98 47	96 42	95 08	93 33	56
60	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	113 24	111 00	109 12	107 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.18	2.14	2.10	2.06	2.02	1.99	1.95	1.92	1.89	1.85	1.82	1.79	$\Delta_1 h$
Log.	0.338 46	0.330 41	0.322 22	0.313 87	0.305 35	0.298 85	0.290 03	0.283 30	0.276 46	0.267 17	0.260 07	0.252 85	Log.
Limit	44	44	45	45	46	47	47	48	48	49	50	50	Minutes
Meridian	48°	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 28	0 27	0 27	0 27	0 26	0 26	0 25	0 25	0 24	0 24	0 23	4
8	1 53	1 52	1 50	1 47	1 45	1 44	1 42	1 41	1 39	1 38	1 36	1 35	8
12	4 14	4 11	4 06	4 02	3 57	3 54	3 50	3 48	3 43	3 40	3 37	3 34	12
16	7 30	7 25	7 18	7 10	7 03	6 58	6 50	6 44	6 37	6 32	6 27	6 18	16
20	11 44	11 36	11 24	11 12	11 00	10 52	10 40	10 32	10 20	10 12	10 04	9 52	20
24	16 54	16 42	16 25	16 08	15 51	15 39	15 22	15 10	14 53	14 41	14 30	14 12	24
28	23 00	22 44	22 21	21 57	21 33	21 18	20 54	20 39	20 15	20 00	19 44	19 21	28
32	30 02	29 42	29 11	28 40	28 09	27 49	27 18	26 58	26 27	26 07	25 46	25 16	32
36	38 01	37 35	36 56	36 18	35 39	35 13	34 34	34 08	33 29	33 03	32 37	31 58	36
40	46 56	46 24	45 36	44 48	44 00	43 28	42 40	42 08	41 20	40 48	40 16	39 28	40
44	56 47	56 08	55 10	54 13	53 15	52 36	51 38	50 59	50 01	49 22	48 43	47 45	44
48	67 33	66 47	65 38	64 30	63 21	62 35	61 26	60 40	59 31	58 45	57 59	56 50	48
52	79 19	78 25	77 04	75 42	74 21	73 27	72 06	71 12	69 51	68 57	68 03	66 42	52
56	91 59	90 56	89 22	87 49	86 15	85 12	83 38	82 35	81 01	79 58	78 55	77 21	56
60	105 36	104 24	102 36	100 48	99 00	97 48	96 00	94 48	93 00	91 48	90 36	88 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.76	1.74	1.71	1.68	1.65	1.63	1.60	1.58	1.55	1.53	1.51	1.48	$\Delta_1 h$
Log.	0.245 51	0.240 55	0.233 00	0.225 31	0.217 48	0.212 19	0.204 12	0.198 66	0.190 33	0.184 69	0.178 98	0.170 26	Log.
Limit	51	52	53	54	54	55	56	57	58	58	59	60	Minutes
Meridian	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	Altitudes

Latitude 42° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 22	0 22	0 22	0 22	0 22	0 21	0 21	0 20	0 20	0 20	0 19	4
8	1 34	1 32	1 30	1 29	1 28	1 26	1 25	1 23	1 23	1 21	1 20	1 19	8
12	3 31	3 24	3 23	3 20	3 17	3 14	3 11	3 08	3 06	3 03	2 59	2 57	12
16	6 13	6 06	6 01	5 56	5 51	5 46	5 41	5 36	5 30	5 25	5 17	5 15	16
20	9 44	9 32	9 24	9 16	9 08	9 00	8 52	8 44	8 36	8 28	8 16	8 12	20
24	14 01	13 43	13 32	13 21	13 09	12 58	12 46	12 35	12 23	12 11	11 54	11 48	24
28	19 05	18 42	18 26	18 10	17 54	17 38	17 23	17 07	16 52	16 36	16 12	16 05	28
32	24 55	24 25	24 04	23 43	23 23	23 02	22 42	22 21	22 01	21 41	21 10	21 00	32
36	31 32	30 53	30 27	30 02	29 36	29 10	28 44	28 18	27 52	27 26	27 47	26 34	36
40	38 56	38 08	37 36	37 04	36 32	36 00	35 28	34 56	34 24	33 52	33 04	32 48	40
44	47 06	46 08	45 29	44 51	44 13	43 34	42 55	42 16	41 37	40 59	40 00	39 41	44
48	56 04	54 55	54 09	53 22	52 36	51 50	51 04	50 18	49 32	48 46	47 37	47 14	48
52	65 48	64 27	63 33	62 38	61 44	60 50	59 56	59 02	58 08	57 14	55 53	55 26	52
56	76 18	74 44	73 41	72 39	71 37	70 34	69 31	68 28	67 25	66 23	64 48	64 17	56
60	87 36	85 48	84 36	83 24	82 12	81 00	79 48	78 36	77 24	76 12	74 24	73 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.46	1.43	1.41	1.39	1.37	1.35	1.33	1.31	1.29	1.27	1.24	1.23	$\triangle_1$h
Log.	0.164 35	0.155 34	0.149 22	0.143 01	0.36 72	0.130 33	0.123 85	0.117 27	0.110 59	0.103 80	0.093 42	0.089 91	Log.
Limit	61	62	62	63	64	65	66	66	67	68	69	70	Minutes
Meridian	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 19	0 18	0 18	0 17	0 17	...	...	...	...	4
8	1 17	1 16	1 15	1 13	1 12	1 11	1 10	1 08	...	...	...	...	8
12	2 54	2 51	2 48	2 45	2 42	2 39	2 37	2 34	...	...	...	...	12
16	5 10	5 05	5 00	4 55	4 50	4 45	4 39	4 34	...	...	...	...	16
20	8 04	7 56	7 48	7 40	7 32	7 24	7 16	7 08	...	...	...	...	20
24	11 37	11 26	11 14	11 03	10 51	10 40	10 28	10 16	...	...	...	...	24
28	15 49	15 33	15 17	15 01	14 46	14 30	14 15	13 59	...	...	...	...	28
32	20 39	20 18	19 58	19 37	19 17	18 56	18 36	18 16	...	...	...	...	32
36	26 08	25 43	25 17	24 51	24 25	23 59	23 33	23 07	...	...	...	...	36
40	32 16	31 44	31 12	30 40	30 08	29 36	29 04	28 32	...	...	...	...	40
44	39 02	38 24	37 46	37 07	36 28	35 49	35 10	34 32	...	...	...	...	44
48	46 28	45 41	44 55	44 09	43 23	42 37	41 51	41 05	...	...	...	...	48
52	54 32	53 37	52 43	51 49	50 55	50 01	49 07	48 13	...	...	...	...	52
56	63 14	62 12	61 10	60 07	59 04	58 01	56 58	55 56	...	...	...	...	56
60	72 36	71 24	70 12	69 00	67 48	66 36	65 24	64 12	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.21	1.19	1.17	1.15	1.13	1.11	1.09	1.07	...	...	...	...	$\triangle_1$h
Log.	0.082 79	0.075 55	0.068 19	0.060 70	0.053 08	0.045 32	0.037 43	0.029 38	... ...	... ...	... ...	... ...	Log.
Limit	71	72	73	74	75	77	78	78					Minutes
Meridian	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	Altitudes

Latitude 42° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	0 14	0 14	0 14	0 13	0 13	0 12	0 12	4
8	...	...	...	...	...	0 56	0 55	0 54	0 52	0 51	0 50	0 50	8
12	...	...	...	...	...	2 07	2 04	2 01	1 58	1 55	1 52	1 51	12
16	...	...	...	...	...	3 45	3 40	3 35	3 30	3 25	3 19	3 17	16
20	...	...	...	...	...	5 52	5 44	5 36	5 28	5 20	5 12	5 08	20
24	...	...	...	...	...	8 27	8 16	8 04	7 53	7 41	7 29	7 23	24
28	...	...	...	...	...	11 30	11 14	10 58	10 43	10 27	10 12	10 04	28
32	...	...	...	...	...	15 01	14 40	14 20	13 59	13 39	13 19	13 09	32
36	...	...	...	...	...	19 01	18 35	18 09	17 43	17 17	16 51	16 38	36
40	...	...	...	...	...	23 28	22 56	22 24	21 52	21 20	20 48	20 32	40
44	...	...	...	...	...	28 24	27 45	27 06	26 28	25 49	25 10	24 51	44
48	...	...	...	...	...	33 47	33 01	32 15	31 29	30 43	29 55	29 32	48
52	...	...	...	...	...	39 39	38 45	57 51	36 57	36 03	35 09	34 42	52
56	...	...	...	...	...	46 00	44 57	43 54	42 52	41 49	40 46	40 15	56
60	...	...	...	...	...	52 48	51 36	50 24	49 12	48 00	46 48	46 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	0.88	0.86	0.84	0.82	0.80	0.78	0.77	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	9.944 48	9.934 50	9.924 28	9.913 81	9.903 09	9.892 09	9.886 49	Log.
Limit						72	73	74	75	76	78	80	Minutes
Meridian	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	0 08	4
8	0 48	0 47	0 45	0 43	0 42	0 40	0 39	0 38	0 37	0 36	0 35	0 33	8
12	1 48	1 45	1 41	1 37	1 35	1 32	1 29	1 26	1 24	1 21	1 18	1 15	12
16	3 12	3 07	2 59	2 54	2 49	2 44	2 39	2 34	2 28	2 23	2 18	2 13	16
20	5 00	4 52	4 40	4 32	4 24	4 16	4 08	4 00	3 52	3 44	3 36	3 28	20
24	7 12	7 00	6 43	6 32	6 21	6 09	5 58	5 46	5 34	5 23	5 11	5 00	24
28	9 48	9 33	9 09	8 53	8 37	8 21	8 06	7 50	7 35	7 19	7 03	6 48	28
32	12 48	12 28	11 57	11 36	11 15	10 55	10 34	10 14	9 54	9 33	9 13	8 52	32
36	16 12	15 46	15 07	14 42	14 16	13 50	13 24	12 58	12 32	12 06	11 40	11 14	36
40	20 00	19 28	18 40	18 08	17 36	17 04	16 02	16 00	15 28	14 56	14 24	13 52	40
44	24 12	23 33	22 35	21 57	21 18	20 39	20 01	19 22	18 43	18 04	17 25	16 47	44
48	28 46	28 00	26 51	26 08	25 20	24 34	23 48	23 02	22 16	21 30	20 44	19 58	48
52	33 48	32 54	31 33	30 38	29 44	28 50	27 56	27 02	26 09	25 14	24 20	23 26	52
56	39 12	38 09	36 35	35 33	34 30	33 27	32 25	31 22	30 19	29 16	28 13	27 11	56
60	45 00	43 48	42 00	40 48	39 36	38 24	37 12	36 00	34 48	33 36	32 24	31 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.75	0.73	0.70	0.68	0.66	0.64	0.62	0.60	0.58	0.56	0.54	0.52	$\triangle_1 h$
Log.	9.875 06	9.863 32	9.845 10	9.832 51	9.819 54	9.806 18	9.792 39	9.778 15	9.763 43	9.748 19	9.732 39	9.716 00	Log.
Limit	81	81	82	83	83	83	84	84	85	85	85	86	Minutes
Meridian	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Altitudes

Latitude 43° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 34	0 35	0 35	0 35	0 36	0 37	0 38	0 38	0 39	0 41	0 42	0 43	4
8	2 15	2 17	2 20	2 23	2 26	2 28	2 32	2 35	2 39	2 43	2 46	2 50	8
12	5 03	5 09	5 15	5 21	5 29	5 34	5 41	5 49	5 58	6 06	6 14	6 23	12
16	9 01	9 11	9 21	9 31	9 43	9 54	10 07	10 19	10 34	10 50	11 06	11 21	16
20	14 04	14 20	14 36	14 52	15 12	15 28	15 48	16 08	16 32	16 56	17 20	17 44	20
24	20 16	20 39	21 02	21 24	21 53	22 17	22 45	23 14	23 48	24 23	24 58	25 33	24
28	27 34	28 05	28 37	29 09	29 48	30 19	30 58	31 38	32 25	33 11	33 58	34 45	28
32	36 00	36 41	37 22	38 04	38 55	39 35	40 27	41 18	42 20	43 21	44 22	45 23	32
36	45 35	46 27	47 19	48 10	49 15	50 07	51 12	52 16	53 34	54 52	56 10	57 28	36
40	56 16	57 20	58 24	59 28	60 48	61 52	63 12	64 32	66 08	67 44	69 20	70 56	40
44	68 05	69 23	70 40	71 57	73 34	74 52	76 39	78 05	80 01	81 57	83 54	85 50	44
48	81 01	82 33	84 05	85 38	87 33	89 05	91 00	92 56	95 14	97 32	99 50	...	48
52	95 05	96 53	98 41	100 30	102 45	104 33	106 48	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.11	2.15	2.19	2.23	2.28	2.32	2.37	2.42	2.48	2.54	2.60	2.66	$\Delta_1 h$
Log.	0.324 28	0.332 44	0.340 44	0.348 30	0.357 93	0.365 49	0.374 75	0.383 82	0.394 45	0.404 83	0.414 97	0.424 88	Log.
Limit	45	44	43	42	42	42	41	41	40	40	39	38	Minutes
Meridian	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 45	0 46	0 47	0 49	0 50	0 51	0 54	0 55	0 57	0 59	1 02	4
8	2 55	2 59	3 04	3 09	3 15	3 20	3 27	3 34	3 41	3 49	3 59	4 07	8
12	6 33	6 43	6 53	7 05	7 18	7 30	7 45	8 01	8 17	8 36	8 56	9 16	12
16	11 39	11 57	12 15	12 35	12 58	13 22	13 47	14 15	14 43	15 16	15 52	16 28	16
20	18 12	18 40	19 08	19 40	20 16	20 52	21 32	22 16	23 00	23 52	24 48	25 44	20
24	26 12	26 53	27 33	28 19	29 11	30 03	31 00	32 04	33 07	34 22	35 43	37 04	24
28	35 41	36 35	37 30	38 33	39 43	40 54	42 13	43 38	45 05	46 47	48 37	50 26	28
32	46 36	47 47	48 59	50 21	51 53	53 25	55 08	57 00	58 53	61 06	63 29	65 52	32
36	58 58	60 29	62 00	63 43	65 40	67 37	69 46	72 09	74 31	77 20	...	...	36
40	72 48	74 40	76 32	78 40	81 04	83 28	86 08	89 04	92 00	...	...	...	40
44	88 05	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.73	2.80	2.87	2.95	3.04	3.13	3.23	3.34	3.45	3.58	3.72	3.86	$\Delta_1 h$
Log.	0.436 16	0.447 16	0.457 88	0.469 82	0.482 87	0.495 54	0.509 20	0.523 75	0.537 82	0.553 88	0.570 54	0.586 59	Log.
Limit	37	36	36	35	35	34	33	32	32	31	30	29	Minutes
Meridian	59°	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 04	1 07	1 10	1 15	1 18	1 23	1 29	1 34	1 42	1 51	2 02	2 15	4
8	4 18	4 30	4 43	4 57	5 13	5 32	5 55	6 18	6 48	7 24	8 07	9 01	8
12	9 40	10 06	10 35	11 08	11 46	12 27	13 16	14 13	15 19	16 40	18 15	20 17	12
16	17 12	17 58	18 49	19 48	20 54	22 09	23 36	25 15	27 13	29 36	32 29	36 03	16
20	26 52	28 04	29 24	30 56	32 40	34 36	36 52	39 28	42 32	46 16	50 44	56 20	20
24	38 41	40 25	42 20	44 33	47 02	49 50	53 05	56 50	61 15	...	...	...	24
28	52 40	55 01	57 38	60 37	64 02	...	...	...	...	...	...	...	28
32	68 47	71 51	75 16	79 11	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.03	4.21	4.41	4.64	4.90	5.19	5.53	5.92	6.38	6.94	7.61	8.45	$\triangle_1 h$
Log.	0.605 31	0.624 28	0.644 44	0.666 52	0.690 20	0.715 17	0.742 73	0.772 32	0.804 82	0.841 36	0.881 38	0.926 86	Log.
Limit	28	27	26	25	24	22	21	20	19	18	17	16	Minutes
Meridian	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 32	2 55	3 27	...	...	...	...	...	...	...	...	...	4
8	10 10	11 42	13 50	...	...	...	...	...	...	...	...	...	8
12	22 52	26 20	31 10	...	...	...	...	...	...	...	...	...	12
16	40 40	46 48	...	...	...	...	...	...	...	...	...	...	16
20	...	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	9.53	10.97	12.98	...	...	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.979 09	1.040 21	1.113 27	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	14	12	10	8	7	4	2	0	2	4	7	9	Minutes
Meridian	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	Altitudes

Latitude 43° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 56	2 24	2 01	1 43	1 31	1 20	1 10	1 03	0 58	0 51	0 49	0 43	4
8	11 45	9 37	8 05	6 56	6 01	5 18	4 43	4 13	3 49	3 27	3 08	2 51	8
12	26 27	21 37	18 10	15 35	13 33	11 58	10 37	9 31	8 34	7 45	7 04	6 26	12
16	...	38 27	32 18	27 41	24 07	21 14	18 51	16 53	15 14	13 47	12 32	11 26	16
20	...	...	50 28	43 16	37 40	33 12	29 28	26 24	23 48	21 32	19 36	17 52	20
24	...	...	...	...	...	47 48	42 26	38 01	34 16	31 00	28 13	25 44	24
28	...	...	...	...	...	...	...	51 45	46 39	42 13	38 25	35 01	28
32	...	...	...	...	...	...	...	...	60 56	55 08	50 11	45 44	32
36	...	...	...	...	..	...	...	...	...	...	63 30	57 44	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	11.02	9.01	7.57	6.49	5.65	4.98	4.42	3.96	3.57	3.23	2.94	2.68	Δ_1h
Log.	1.042 18	0.954 72	0.879 10	0.812 24	0.752 05	0.697 23	0.645 42	0.597 70	0.552 67	0.509 20	0.468 35	0.428 13	Log.
Limit	11	13	15	16	18	20	22	24	26	28	30	32	Minutes
Meridian	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 39	0 36	0 33	0 30	0 28	0 26	0 24	0 22	0 20	0 19	0 17	0 15	4
8	2 38	2 24	2 13	2 02	1 53	1 43	1 36	1 28	1 22	1 15	1 09	1 03	8
12	5 55	5 24	4 58	4 35	4 14	3 53	3 36	3 17	3 03	2 48	2 36	2 33	12
16	10 29	9 36	8 50	8 09	7 30	6 55	6 21	5 51	5 25	5 00	4 36	4 13	16
20	16 24	15 00	13 48	12 44	11 44	10 48	9 56	9 08	8 28	7 48	7 12	6 36	20
24	23 37	21 36	19 52	18 20	16 54	15 04	14 18	13 09	12 11	11 14	10 22	9 30	24
28	32 09	29 24	27 03	24 58	23 00	21 10	19 29	17 54	16 36	15 17	14 07	12 57	28
32	41 59	38 24	35 20	32 36	30 02	27 38	25 26	23 23	21 41	19 58	18 26	16 54	32
36	53 08	48 36	44 43	41 15	38 01	35 00	31 11	29 36	27 26	25 17	23 20	21 23	36
40	65 36	60 00	55 12	50 56	46 56	43 12	39 44	36 32	33 52	31 12	28 48	26 24	40
44	...	72 36	66 48	61 37	56 47	52 17	48 04	44 13	40 59	37 46	34 51	31 56	44
48	...	...	...	73 21	67 33	62 12	57 13	52 36	48 46	44 55	41 28	38 01	48
52	...	...	...	...	79 19	73 00	67 09	61 44	57 14	52 43	48 40	44 37	52
56	...	...	...	...	...	...	77 52	71 37	66 23	61 10	56 27	51 44	56
60	...	...	...	...	...	...	...	...	76 12	70 12	64 48	59 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	2.46	2.25	2.07	1.91	1.76	1.62	1.49	1.37	1.27	1.17	1.08	0.99	Δ_1h
Log.	0.390 94	0.352 18	0.315 97	0.281 03	0.245 51	0.209 52	0.173 19	0.136 72	0.103 80	0.068 19	0.033 42	9.995 64	Log.
Limit	34	36	38	40	42	43	45	47	49	51	54	57	Minutes
Meridian	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	62°	Altitudes

Latitude 43° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 34	0 33	0 32	0 31	0 31	0 30	0 30	0 30	0 29	0 29	0 28	0 28	4
8	2 15	2 13	2 10	2 07	2 05	2 02	2 01	1 59	1 57	1 55	1 54	1 52	8
12	5 03	4 58	4 52	4 47	4 43	4 37	4 32	4 28	4 23	4 19	4 16	4 11	12
16	9 01	8 50	8 40	8 29	8 21	8 11	8 04	7 56	7 49	7 41	7 33	7 25	16
20	14 04	13 48	13 32	13 16	13 04	12 48	12 36	12 24	12 12	12 00	11 48	11 36	20
24	20 16	19 52	19 29	19 06	18 49	18 26	18 09	17 52	17 34	17 17	16 59	16 42	24
28	27 34	27 03	26 32	26 01	25 37	25 06	24 42	24 18	23 55	23 31	23 08	22 44	28
32	36 00	35 20	34 39	33 58	33 27	32 46	32 15	31 44	31 13	30 43	30 13	29 42	32
36	45 35	44 43	43 51	42 59	42 20	41 28	40 50	40 11	39 32	38 53	38 14	37 35	36
40	56 16	55 12	54 08	53 04	52 16	51 12	50 24	49 36	48 48	48 00	47 12	46 24	40
44	68 05	66 48	65 30	64 12	63 14	61 57	60 59	60 01	59 03	58 05	57 07	56 08	44
48	81 01	79 29	77 57	76 25	75 16	73 44	72 34	71 25	70 16	69 07	67 56	66 47	48
52	95 05	93 17	91 29	89 41	88 20	86 32	85 10	83 49	82 28	81 07	79 46	78 25	52
56	...	...	106 06	104 01	102 26	100 21	98 47	97 13	95 39	94 05	92 31	90 56	56
60	...	...	...	...	...	...	113 24	111 36	109 48	108 00	106 12	104 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△$_1$h	2.11	2.07	2.03	1.99	1.96	1.92	1.89	1.86	1.83	1.80	1.77	1.74	△$_1$h
Log.	0.324 28	0.315 97	0.307 50	0.298 85	0.292 26	0.283 30	0.276 46	0.269 51	0.262 45	0.255 27	0.247 97	0.240 55	Log.
Limit	45	45	46	46	47	48	48	49	49	50	51	51	Minutes
Meridian	47°	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 27	0 27	0 26	0 25	0 25	0 25	0 24	0 23	0 23	0 23	4
8	1 50	1 48	1 46	1 45	1 42	1 42	1 40	1 39	1 36	1 36	1 34	1 33	8
12	4 06	4 03	3 59	3 56	3 51	3 49	3 45	3 42	3 37	3 35	3 32	3 29	12
16	7 18	7 13	7 05	7 00	6 53	6 47	6 39	6 34	6 27	6 21	6 16	6 11	16
20	11 24	11 16	11 04	10 56	10 44	10 36	10 24	10 16	10 04	9 56	9 48	9 40	20
24	16 25	16 14	15 57	15 45	15 28	15 16	14 59	14 47	14 30	14 18	14 06	13 55	24
28	22 21	22 05	21 41	21 25	21 02	20 47	20 23	20 07	19 44	19 29	19 13	18 57	28
32	29 11	28 50	28 19	27 59	27 28	27 08	26 37	26 17	25 46	25 26	25 06	24 45	32
36	36 56	36 31	35 52	35 26	34 47	34 21	33 42	33 16	32 37	32 11	31 45	31 19	36
40	45 36	45 04	44 16	43 44	42 56	42 24	41 36	41 04	40 16	39 44	39 12	38 40	40
44	55 10	54 32	53 24	52 55	51 57	51 18	50 20	49 41	48 43	48 04	47 26	46 47	44
48	65 38	64 53	63 44	62 58	61 49	61 03	59 54	59 08	57 59	57 13	56 27	55 41	48
52	77 04	76 09	74 48	73 54	72 33	71 39	70 18	69 24	68 03	67 09	66 15	65 21	52
56	89 22	88 20	86 46	85 43	84 09	83 06	81 32	80 29	78 55	77 52	76 50	75 37	56
60	102 36	101 24	99 36	98 24	96 36	95 24	93 36	92 24	90 36	89 24	88 12	87 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△$_1$h	1.71	1.69	1.66	1.64	1.61	1.59	1.56	1.54	1.51	1.49	1.47	1.45	△$_1$h
Log.	0.233 00	0.227 89	0.220 11	0.214 84	0.206 83	0.201 40	0.193 12	0.187 52	0.178 98	0.173 19	0.167 32	0.161 37	Log.
Limit	52	53	54	55	55	56	57	58	58	59	60	61	Minutes
Meridian	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	Altitudes

Latitude 43° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 22	0 22	0 22	0 22	0 21	0 21	0 20	0 20	0 20	0 19	0 19	4
8	1 32	1 30	1 28	1 27	1 26	1 24	1 23	1 22	1 21	1 20	1 18	1 17	8
12	3 24	3 22	3 19	3 16	3 13	3 10	3 07	3 05	3 02	2 59	2 56	2 53	12
16	6 06	5 58	5 53	5 48	5 43	5 38	5 33	5 27	5 22	5 17	5 12	5 07	16
20	9 32	9 20	9 12	9 04	8 56	8 48	8 40	8 32	8 24	8 16	8 08	8 00	20
24	13 43	13 26	13 15	13 04	12 52	12 41	12 29	12 17	12 06	11 54	11 43	11 31	24
28	18 42	18 18	18 02	17 46	17 30	17 15	16 59	16 44	16 28	16 12	15 57	15 41	28
32	24 25	23 54	23 33	23 12	22 52	22 31	22 11	21 51	21 30	21 10	20 49	20 29	32
36	30 53	30 14	29 49	29 23	28 57	28 31	28 05	27 39	27 13	26 47	26 21	25 55	36
40	38 08	37 20	36 48	36 16	35 44	35 12	34 40	34 08	33 36	33 04	32 32	32 00	40
44	46 08	45 10	44 32	43 53	43 14	42 36	41 57	41 18	40 39	40 00	39 12	38 43	44
48	54 55	53 46	52 59	52 13	51 27	50 41	49 55	49 09	48 23	47 37	46 51	46 05	48
52	64 27	63 06	62 11	61 17	60 23	59 29	58 35	57 41	56 47	55 53	54 59	54 05	52
56	74 44	73 10	72 08	71 05	70 02	69 00	67 57	66 54	65 51	64 48	63 46	62 43	56
60	85 48	84 00	82 48	81 36	80 24	79 12	78 00	76 48	75 36	74 24	73 12	72 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.43	1.40	1.38	1.36	1.34	1.32	1.30	1.28	1.26	1.24	1.22	1.20	$\triangle_1$h
Log.	0.155 34	0.146 13	0.139 88	0.133 54	0.127 10	0.120 57	0.113 94	0.107 21	0.100 37	0.093 42	0.086 36	0.079 18	Log.
Limit	62	62	63	64	65	66	67	67	68	69	70	71	Minutes
Meridian	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 19	0 18	0 17	0 17	...	...	...	...	...	4
8	1 16	1 15	1 13	1 12	1 11	1 10	1 08	...	...	...	...	...	8
12	2 51	2 48	2 45	2 42	2 39	2 37	2 34	...	...	...	...	...	12
16	5 05	5 00	4 55	4 50	4 45	4 39	4 34	...	...	...	...	...	16
20	7 56	7 48	7 40	7 32	7 24	7 16	7 08	...	...	...	...	...	20
24	11 26	11 14	11 03	10 51	10 40	10 28	10 16	...	...	...	...	...	24
28	15 33	15 17	15 01	14 46	14 30	14 15	13 59	...	...	...	...	...	28
32	20 18	19 58	19 37	19 17	18 56	18 36	18 16	...	...	...	...	...	32
36	25 43	25 17	24 51	24 25	23 59	23 33	23 07	...	...	...	...	...	36
40	31 44	31 12	30 40	30 08	29 36	29 04	28 32	...	...	...	...	...	40
44	38 24	37 46	37 07	36 28	35 49	35 10	34 32	...	...	...	...	...	44
48	45 41	44 55	42 09	43 23	42 37	41 51	41 05	...	...	...	...	...	48
52	53 37	52 43	51 49	50 55	50 01	49 07	48 13	...	...	...	...	...	52
56	62 12	61 10	60 07	59 04	58 01	56 58	55 56	...	...	...	...	...	56
60	71 24	70 12	69 00	67 48	66 36	65 24	64 12	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.19	1.17	1.15	1.13	1.11	1.09	1.07	...	...	...	...	...	$\triangle_1$h
Log.	0.075 55	0.068 19	0.060 70	0.053 08	0.045 32	0.037 43	0.029 38	... ...	... ...	... ...	... ...	... ...	Log.
Limit	72	73	74	75	76	77	78						Minutes
Meridian	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	0 14	0 14	0 14	0 13	0 13	0 12	0 12	0 12	4
8	...	...	...	...	0 56	0 55	0 54	0 53	0 52	0 51	0 50	0 49	8
12	...	...	...	...	2 07	2 05	2 02	1 59	1 56	1 54	1 51	1 50	12
16	...	...	...	...	3 45	3 43	3 38	3 33	3 28	3 22	3 17	3 14	16
20	...	...	...	...	5 52	5 48	5 40	5 32	5 24	5 16	5 08	5 04	20
24	...	...	...	...	8 27	8 21	8 10	7 58	7 47	7 35	7 23	7 18	24
28	...	...	...	...	11 30	11 22	11 06	10 51	10 35	10 20	10 04	9 56	28
32	...	...	...	...	15 01	14 51	14 30	14 10	13 49	13 29	13 09	12 58	32
36	...	...	...	...	19 01	18 48	18 22	17 56	17 30	17 04	16 38	16 25	36
40	...	...	...	...	23 28	23 12	22 40	22 08	21 36	21 04	20 32	20 16	40
44	...	...	...	...	28 24	28 05	27 26	26 47	26 08	25 29	24 51	24 31	44
48	...	...	...	...	33 47	33 24	32 38	31 52	31 06	30 18	29 32	29 09	48
52	...	...	...	...	39 39	39 12	38 18	37 24	36 30	35 36	34 42	34 15	52
56	...	...	...	...	46 00	45 29	44 26	43 23	42 20	41 17	40 15	39 43	56
60	...	...	...	...	52 48	52 12	51 00	49 48	48 36	47 24	46 12	45 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	0.88	0.87	0.85	0.83	0.81	0.79	0.77	0.76	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	9.944 48	9.939 52	9.929 42	9.919 08	9.908 49	9.897 63	9.886 49	9.880 81	Log.
Limit					71	71	72	73	75	77	78	80	Minutes
Meridian	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 11	0 11	0 11	0 11	0 11	0 10	0 09	0 09	0 09	0 09	0 08	4
8	0 47	0 46	0 44	0 42	0 41	0 40	0 39	0 38	0 37	0 35	0 34	0 33	8
12	1 47	1 44	1 39	1 36	1 33	1 30	1 27	1 25	1 22	1 19	1 16	1 13	12
16	3 09	3 04	2 57	2 52	2 47	2 42	2 37	2 31	2 26	2 21	2 16	2 11	16
20	4 56	4 48	4 36	4 28	4 20	4 12	4 04	3 56	3 48	3 40	3 32	3 24	20
24	7 06	6 55	6 38	6 26	6 15	6 03	5 52	5 40	5 28	5 17	5 05	4 54	24
28	9 40	9 25	9 01	8 45	8 29	8 14	7 58	7 43	7 27	7 11	6 56	6 40	28
32	12 38	12 17	11 46	11 26	11 05	10 45	10 24	10 04	9 44	9 23	9 03	8 42	32
36	15 59	15 33	14 55	14 29	14 03	13 37	13 11	12 45	12 18	11 53	11 27	11 01	36
40	19 44	19 12	18 24	17 52	17 20	16 48	16 16	15 44	15 12	14 40	14 08	13 36	40
44	23 52	23 14	22 16	21 38	20 59	20 20	19 41	19 02	18 24	17 45	17 06	16 27	44
48	28 23	27 37	26 29	25 43	24 57	24 11	23 25	22 39	21 54	21 07	20 21	19 35	48
52	33 21	32 27	31 05	30 11	29 17	28 23	27 29	26 35	25 41	24 47	23 53	22 59	52
56	38 40	37 38	36 04	35 02	33 59	32 56	31 53	30 50	29 48	28 45	27 42	26 39	56
60	44 24	43 12	41 24	40 12	39 00	37 48	36 36	35 24	34 12	33 00	31 48	30 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.74	0.72	0.69	0.67	0.65	0.63	0.61	0.59	0.57	0.55	0.53	0.51	$\triangle_1$h
Log.	9.869 23	9.857 33	9.838 85	9.826 07	9.812 91	9.799 34	9.785 33	9.770 85	9.755 87	9.740 36	9.724 28	9.707 57	Log.
Limit	81	81	81	82	83	84	84	84	84	85	85	86	Minutes
Meridian	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 32	0 33	0 34	0 35	0 35	0 36	0 36	0 37	0 38	0 38	0 39	0 41	4
8	2 10	2 13	2 15	2 17	2 20	2 24	2 26	2 29	2 32	2 36	2 40	2 43	8
12	4 52	4 58	5 03	5 09	5 15	5 23	5 29	5 35	5 43	5 50	5 59	6 07	12
16	8 40	8 50	9 01	9 11	9 21	9 33	9 43	9 57	10 09	10 22	10 37	10 53	16
20	13 32	13 48	14 04	14 20	14 36	14 56	15 12	15 32	15 52	16 12	16 36	17 00	20
24	19 29	19 52	20 16	20 39	21 02	21 30	21 53	22 22	22 51	23 19	23 54	24 29	24
28	26 32	27 03	27 34	28 05	28 37	29 16	29 48	30 27	31 06	31 46	32 33	33 19	28
32	34 39	35 20	36 00	36 41	37 22	38 14	38 55	39 46	40 37	41 29	42 30	43 31	32
36	43 51	44 43	45 35	46 27	47 19	48 23	49 15	50 20	51 25	52 29	53 47	55 05	36
40	54 08	55 12	56 16	57 20	58 24	59 44	60 48	62 08	63 28	64 48	66 24	68 00	40
44	65 30	66 48	68 05	69 23	70 40	72 16	73 34	75 11	76 48	78 24	80 20	82 17	44
48	77 57	79 29	81 01	82 33	84 05	86 01	87 33	89 28	91 23	93 19	95 37	...	48
52	91 29	93 17	95 05	96 53	98 41	100 57	102 45	105 00	107 15	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.03	2.07	2.11	2.15	2.19	2.24	2.28	2.33	2.38	2.43	2.49	2.55	$\triangle_1$h
Log.	0.307 50	0.315 97	0.324 28	0.332 44	0.340 44	0.350 25	0.357 93	0.367 36	0.376 58	0.385 61	0.396 20	0.406 54	Log.
Limit	46	45	44	43	43	43	42	42	41	41	40	39	Minutes
Meridian	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 42	0 43	0 44	0 45	0 46	0 47	0 49	0 51	0 52	0 54	0 56	0 58	4
8	2 47	2 51	2 56	3 00	3 05	3 10	3 16	3 22	3 29	3 36	3 44	3 52	8
12	6 15	6 24	6 35	6 44	6 56	7 10	7 21	7 35	7 50	8 05	8 24	8 42	12
16	11 09	11 24	11 41	12 00	12 20	12 42	13 03	13 29	13 54	14 23	14 56	15 30	16
20	17 24	17 48	18 16	18 44	19 16	19 52	20 24	21 04	21 44	22 28	23 20	24 12	20
24	25 04	25 38	26 18	26 59	27 45	28 36	29 23	30 21	31 18	32 21	33 36	34 51	24
28	34 06	34 53	35 48	36 43	37 46	38 57	39 59	41 17	42 36	44 02	45 44	47 26	28
32	44 32	45 34	46 46	47 57	49 19	50 52	52 13	53 55	55 38	57 31	59 44	61 57	32
36	56 23	57 41	59 11	60 42	62 26	64 22	66 06	68 16	70 25	72 48	75 36	78 25	36
40	69 36	71 12	73 04	74 56	77 04	79 28	81 36	84 16	86 56	89 52	...	...	40
44	84 13	86 10	88 24	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.61	2.67	2.74	2.81	2.89	2.98	3.06	3.16	3.26	3.37	3.50	3.63	$\triangle_1$h
Log.	0.416 64	0.426 51	0.437 75	0.448 71	0.460 90	0.474 22	0.485 72	0.499 69	0.513 22	0.527 63	0.544 07	0.559 91	Log.
Limit	33	35	37	37	36	35	34	33	33	32	31	30	Minutes
Meridian	58°	59°	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 00	1 03	1 06	1 09	1 12	1 16	1 21	1 26	1 32	1 39	1 48	1 58	4
8	4 02	4 11	4 23	4 35	4 49	5 06	5 24	5 44	6 09	6 38	7 18	7 54	8
12	9 03	9 26	9 51	10 19	10 51	11 27	12 09	12 55	13 50	14 54	16 11	17 46	12
16	16 05	16 46	17 33	18 21	19 17	20 21	21 35	22 57	23 34	26 30	28 45	31 34	16
20	25 08	26 12	27 24	28 40	30 08	31 48	33 44	35 52	38 24	41 24	44 56	49 20	20
24	36 11	37 43	39 28	41 17	43 24	45 47	48 35	51 39	55 18	59 27	...	...	24
28	49 16	51 22	53 42	56 11	59 04	62 18	66 07	70 18	...	...	...	...	28
32	64 21	67 05	70 08	73 23	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	.	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	..	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.77	3.93	4.11	4.30	4.52	4.77	5.06	5.38	5.76	6.21	6.74	7.40	$\triangle_1 h$
Log.	0.576 34	0.594 39	0.613 84	0.633 47	0.655 14	0.678 52	0.704 15	0.730 78	0.760 42	0.793 09	0.828 66	0.869 23	Log.
Limit	29	28	27	26	25	24	23	21	20	19	18	17	Minutes
Meridian	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 11	2 28	2 51	3 21	...	...	...	...	...	...	...	...	4
8	8 46	9 53	11 21	13 26	...	...	...	...	...	...	...	...	8
12	19 42	22 14	25 33	30 13	...	...	...	...	...	...	...	...	12
16	35 02	39 30	...	...	...	...	...	...	...	...	...	...	16
20	54 44	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	8.21	9.26	10.65	12.59	...	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.914 34	0.966 61	1.027 35	1.100 03	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	16	14	12	10	9	6	4	2	0	2	4	6	Minutes
Meridian	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	Altitudes

Latitude 44° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	2 50	2 19	1 56	1 40	1 27	1 16	1 08	1 01	0 54	0 50	0 45	4
8	...	11 20	9 16	7 47	6 40	5 49	5 06	4 32	4 03	3 39	3 18	3 00	8
12	...	25 30	20 51	17 30	15 00	13 04	11 29	10 12	9 07	8 13	7 25	6 44	12
16	...	45 22	37 05	31 06	26 40	23 12	20 23	18 08	16 13	14 35	13 11	12 00	16
20	...	...	...	48 36	41 40	36 16	31 52	28 20	25 20	22 48	20 36	18 44	20
24	...	...	...	...	...	52 13	45 53	40 48	36 29	32 50	29 40	26 59	24
28	...	...	...	...	...	...	...	55 32	49 39	44 42	40 23	36 43	28
32	...	...	...	...	...	...	...	...	...	58 22	52 44	47 57	32
36	...	...	...	...	...	...	...	...	...	...	66 45	60 42	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	10.63	8.69	7.29	6.25	5.44	4.78	4.25	3.80	3.42	3.09	2.81	$\triangle_1 h$
Log.	... ...	1.026 53	0.939 02	0.862 73	0.795 88	0.735 60	0.679 43	0.628 39	0.579 78	0.534 03	0.489 96	0.448 71	Log.
Limit	9	12	14	15	17	19	21	23	25	27	29	31	Minutes
Meridian	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 41	0 38	0 35	0 31	0 29	0 27	0 24	0 22	0 21	0 19	0 18	0 16	4
8	2 44	2 30	2 17	2 06	1 56	1 46	1 38	1 30	1 23	1 17	1 10	1 04	8
12	6 09	5 37	5 09	4 44	4 20	3 59	3 40	3 23	3 07	2 53	2 38	2 24	12
16	10 55	9 59	9 11	8 24	7 44	7 05	6 32	6 01	5 33	5 07	4 42	4 16	16
20	17 04	15 36	14 20	13 08	12 04	11 04	10 12	9 24	8 40	8 00	7 20	6 40	20
24	24 35	22 28	20 39	18 44	17 23	15 57	14 41	13 32	12 29	11 31	10 34	9 36	24
28	33 27	30 34	28 05	25 45	23 39	21 41	20 00	18 26	16 59	15 41	14 22	13 04	28
32	43 41	39 56	36 41	33 38	30 53	28 19	26 07	23 04	22 11	20 29	18 46	17 04	32
36	55 18	50 33	46 27	42 33	39 06	35 52	33 02	30 27	28 05	25 55	23 46	21 36	36
40	68 16	62 24	57 20	52 32	48 16	44 16	40 48	37 36	34 40	32 00	29 20	26 40	40
44	...	75 30	69 23	63 34	58 24	53 34	49 22	45 29	41 57	38 43	35 30	32 16	44
48	...	...	...	75 39	69 30	63 44	58 45	54 09	49 55	46 05	42 14	38 24	48
52	...	...	...	...	...	74 48	68 57	63 33	58 35	54 05	49 34	45 04	52
56	...	...	...	...	...	...	...	73 41	67 57	62 43	57 30	52 16	56
60	...	...	...	...	...	...	...	...	78 00	72 00	66 00	60 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.56	2.34	2.15	1.97	1.81	1.66	1.53	1.41	1.30	1.20	1.10	1.00	$\triangle_1 h$
Log.	0.408 24	0.369 22	0.332 44	0.294 47	0.257 68	0.220 11	0.184 69	0.149 22	0.113 94	0.079 18	0.041 39	0.00 ...	Log.
Limit	33	35	37	39	41	42	44	46	48	50	53	56	Minutes
Meridian	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	63°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 32	0 32	0 31	0 30	0 30	0 30	0 29	0 29	0 28	0 28	0 27	0 27	4
8	2 10	2 08	2 05	2 03	2 01	1 59	1 57	1 55	1 54	1 52	1 50	1 48	8
12	4 52	4 48	4 43	4 38	4 34	4 28	4 23	4 19	4 16	4 12	4 08	4 03	12
16	8 40	8 32	8 21	8 14	8 06	7 56	7 49	7 41	7 33	7 28	7 20	7 13	16
20	13 32	13 20	13 04	12 52	12 40	12 24	12 12	12 00	11 48	11 40	11 28	11 16	20
24	19 29	19 12	18 49	18 31	18 14	17 52	17 34	17 17	16 59	16 48	16 31	16 14	24
28	26 32	26 08	25 37	25 14	24 50	24 18	23 55	23 31	23 08	22 52	22 29	22 05	28
32	34 39	34 08	33 27	32 57	32 26	31 44	31 13	30 43	30 13	29 52	29 21	28 51	32
36	43 51	43 12	42 20	41 41	41 02	40 11	39 32	38 53	38 14	37 48	37 09	36 31	36
40	54 08	53 20	52 16	51 28	50 40	49 36	48 48	48 00	47 12	46 40	45 52	45 04	40
44	65 30	64 32	63 14	62 16	61 18	60 01	59 03	58 05	57 07	56 28	55 30	54 32	44
48	77 57	76 48	75 16	74 07	72 58	71 25	70 16	69 07	67 56	67 10	66 01	64 53	48
52	91 29	90 08	88 20	86 59	85 38	83 49	82 28	81 07	79 46	78 52	77 31	76 09	52
56	...	...	102 26	100 52	99 18	97 13	95 39	94 05	92 31	91 28	89 54	88 20	56
60	...	...	...	...	114 00	111 36	109 48	108 00	106 12	105 00	103 12	101 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.03	2.00	1.96	1.93	1.90	1.86	1.83	1.80	1.77	1.75	1.72	1.69	$\triangle_1 h$
Log.	0.307 50	0.301 03	0.292 26	0.285 56	0.278 75	0.269 51	0.262 45	0.255 27	0.247 97	0.243 04	0.235 53	0.227 89	Log.
Limit	46	46	47	47	48	48	49	50	50	51	52	52	Minutes
Meridian	46°	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 26	0 25	0 25	0 25	0 24	0 24	0 23	0 23	0 22	0 22	4
8	1 47	1 45	1 43	1 42	1 41	1 39	1 37	1 36	1 35	1 33	1 32	1 30	8
12	4 00	3 56	3 53	3 49	3 46	3 42	3 39	3 36	3 34	3 29	3 24	3 23	12
16	7 08	7 00	6 55	6 47	6 42	6 34	6 29	6 24	6 18	6 11	6 06	6 01	16
20	11 08	10 56	10 48	10 36	10 28	10 16	10 08	10 00	9 52	9 40	9 32	9 24	20
24	16 02	15 45	15 34	15 16	15 04	14 47	14 36	14 24	14 12	13 55	13 43	13 32	24
28	21 49	21 25	21 10	20 47	20 31	20 07	19 52	19 36	19 21	18 57	18 42	18 26	28
32	28 30	27 59	27 38	27 08	26 48	26 17	25 56	25 36	25 16	24 45	24 25	24 04	32
36	36 05	35 26	35 00	34 21	33 55	33 16	32 50	32 24	31 58	31 19	30 53	30 27	36
40	44 32	43 44	43 12	42 24	41 52	41 04	40 32	40 00	39 28	38 40	38 08	37 36	40
44	53 54	52 55	52 17	51 18	50 40	49 41	49 03	48 24	47 45	46 47	46 08	45 29	44
48	64 07	62 58	62 12	61 03	60 17	59 08	58 22	57 36	56 50	55 41	54 55	54 09	48
52	75 15	73 54	73 00	71 39	70 45	69 24	68 30	67 36	66 42	65 21	64 27	63 33	52
56	87 18	85 43	84 41	83 06	82 04	80 29	79 27	78 24	77 21	75 37	74 44	73 41	56
60	100 12	98 24	97 12	95 24	94 12	92 24	91 12	90 00	88 48	87 00	85 48	84 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.67	1.64	1.62	1.59	1.57	1.54	1.52	1.50	1.48	1.45	1.43	1.41	$\triangle_1 h$
Log.	0.222 72	0.214 84	0.209 52	0.201 40	0.195 90	0.187 52	0.181 84	0.176 09	0.170 26	0.161 37	0.155 34	0.149 22	Log.
Limit	53	54	55	56	56	57	58	59	59	59	60	61	Minutes
Meridian	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	Altitudes

Latitude 44° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 22	0 21	0 20	0 20	0 20	0 19	0 19	0 19	0 19	4
8	1 29	1 28	1 26	1 25	1 23	1 23	1 21	1 20	1 19	1 18	1 16	1 15	8
12	3 20	3 17	3 14	3 11	3 08	3 06	3 03	3 00	2 57	2 56	2 51	2 50	12
16	5 56	5 51	5 46	5 41	5 36	5 30	5 25	5 20	5 15	5 12	5 05	5 02	16
20	9 16	9 08	9 00	8 52	8 44	8 36	8 28	8 20	8 12	8 08	7 56	7 52	20
24	13 21	13 09	12 58	12 46	12 35	12 23	12 11	12 00	11 48	11 43	11 26	11 20	24
28	18 10	17 54	17 38	17 23	17 07	16 52	16 36	16 20	16 05	15 57	15 33	15 25	28
32	23 43	23 23	23 02	22 42	22 21	22 01	21 41	21 20	21 00	20 49	20 18	20 08	32
36	30 02	29 36	29 10	28 44	28 18	27 52	27 26	27 00	26 34	26 21	25 43	25 30	36
40	37 04	36 32	36 00	35 28	34 56	34 24	33 52	33 20	32 48	32 32	31 44	31 28	40
44	44 51	44 13	43 34	42 55	42 16	41 37	40 59	40 20	39 41	39 12	38 24	38 05	44
48	53 22	52 36	51 50	51 04	50 18	49 32	48 46	48 00	47 14	46 51	45 41	45 18	48
52	62 38	61 44	60 50	59 56	59 02	58 08	57 14	56 20	55 26	54 59	53 37	53 10	52
56	72 39	71 37	70 34	69 31	68 28	67 25	66 23	65 20	64 17	63 46	62 12	61 41	56
60	83 24	82 12	81 00	79 48	78 36	77 24	76 12	75 00	73 48	73 12	71 24	70 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.39	1.37	1.35	1.33	1.31	1.29	1.27	1.25	1.23	1.22	1.19	1.18	$\triangle_1 h$
Log.	0.143 01	0.136 72	0.130 33	0.123 85	0.117 27	0.110 59	0.103 80	0.096 91	0.089 91	0.086 36	0.075 55	0.071 88	Log.
Limit	62	63	64	65	66	67	68	68	69	70	71	72	Minutes
Meridian	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 18	0 18	0 17	0 17	...	...	...	...	...	...	4
8	1 15	1 13	1 11	1 11	1 10	1 08	...	...	...	...	...	...	8
12	2 48	2 45	2 41	2 39	2 37	2 34	...	...	...	...	...	...	12
16	5 00	4 55	4 47	4 45	4 39	4 34	...	...	...	...	...	...	16
20	7 48	7 40	7 28	7 24	7 16	7 08	...	...	...	...	...	...	20
24	11 14	11 03	10 46	10 40	10 28	10 16	...	...	...	...	...	...	24
28	15 17	15 01	14 38	14 30	14 15	13 59	...	...	...	...	...	...	28
32	19 58	19 37	19 06	18 56	18 36	18 16	...	...	...	...	...	...	32
36	25 17	24 51	24 12	23 59	23 33	23 07	...	...	...	...	...	...	36
40	31 12	30 40	29 52	29 36	29 04	28 32	...	...	...	...	...	...	40
44	37 46	37 07	36 09	35 49	35 10	34 32	...	...	...	...	...	...	44
48	44 55	44 09	43 00	42 37	41 51	41 05	...	...	...	...	...	...	48
52	52 43	51 49	50 28	50 01	49 07	48 13	...	...	...	...	...	...	52
56	61 10	60 07	58 33	58 01	56 58	55 56	...	...	...	...	...	...	56
60	70 12	69 00	67 12	66 36	65 24	64 12	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.17	1.15	1.12	1.11	1.09	1.07	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.068 19	0.060 70	0.049 22	0,045 32	0.037 43	0.029 38	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	73	74	75	76	77	78							Minutes
Meridian	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	0 14	0 14	0 14	0 14	0 13	0 13	0 12	0 12	0 12	4
8	...	...	...	0 57	0 55	0 55	0 54	0 52	0 51	0 50	0 49	0 48	8
12	...	...	...	2 08	2 05	2 04	2 01	1 58	1 55	1 52	1 50	1 48	12
16	...	...	...	3 48	3 43	3 40	3 35	3 30	3 25	3 19	3 14	3 12	16
20	...	...	...	5 56	5 48	5 44	5 36	5 28	5 20	5 12	5 04	5 00	20
24	...	...	...	8 33	8 21	8 16	8 04	7 53	7 41	7 29	7 18	7 12	24
28	...	...	...	11 38	11 22	11 14	10 58	10 43	10 27	10 12	9 56	9 48	28
32	...	...	...	15 11	14 51	14 40	14 20	13 59	13 39	13 19	12 58	12 48	32
36	...	...	...	19 14	18 48	18 35	18 09	17 43	17 17	16 51	16 25	16 12	36
40	...	...	...	23 44	23 12	22 56	22 24	21 52	21 20	20 48	20 16	20 00	40
44	...	...	...	28 43	28 05	27 45	27 06	26 28	25 49	25 10	24 31	24 12	44
48	...	...	...	34 10	33 24	33 01	32 15	31 29	30 43	29 55	29 09	28 46	48
52	...	...	...	40 06	39 12	38 45	37 51	36 57	36 03	35 09	34 15	33 48	52
56	...	...	...	46 31	45 29	44 57	43 54	42 52	41 49	40 46	39 44	39 12	56
60	...	...	...	53 24	52 12	51 36	50 24	49 12	48 00	46 48	45 36	45 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	0.89	0.87	0.86	0.84	0.82	0.80	0.78	0.76	0.75	$\triangle_1 h$
Log.	... ...	... ...	... ...	9.949 39	9.939 52	9.934 50	9.924 28	9.913 81	9.903 09	9.892 09	9.880 81	9.875 06	Log.
Limit				69	70	71	72	73	74	76	78	80	Minutes
Meridian	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	0 09	0 08	4
8	0 47	0 45	0 43	0 42	0 41	0 40	0 39	0 38	0 37	0 35	0 34	0 33	8
12	1 45	1 42	1 37	1 36	1 33	1 30	1 27	1 25	1 22	1 19	1 16	1 13	12
16	3 07	3 02	2 54	2 52	2 47	2 42	2 37	2 31	2 26	2 21	2 16	2 11	16
20	4 52	4 44	4 32	4 28	4 20	4 12	4 04	3 56	3 48	3 40	3 32	3 24	20
24	7 00	6 49	6 32	6 26	6 15	6 03	5 52	5 40	5 28	5 17	5 05	4 54	24
28	9 33	9 17	8 53	8 45	8 29	8 14	7 58	7 43	7 27	7 11	6 56	6 40	28
32	12 28	12 07	11 36	11 26	11 05	10 45	10 24	10 04	9 44	9 23	9 03	8 42	32
36	15 46	15 20	14 42	14 29	14 03	13 37	13 11	12 45	12 18	11 53	11 27	11 01	36
40	19 28	18 56	18 08	17 52	17 20	16 48	16 16	15 44	15 12	14 40	14 08	13 36	40
44	23 33	22 54	21 57	21 38	20 59	20 20	19 41	19 02	18 24	17 45	17 06	16 27	44
48	28 00	27 14	26 06	25 43	24 57	24 11	23 25	22 39	21 54	21 07	20 21	19 35	48
52	32 54	32 00	30 38	30 11	29 17	28 23	27 29	26 35	25 41	24 47	23 53	22 59	52
56	38 09	37 06	35 33	35 02	33 59	32 56	31 53	30 50	29 48	28 45	27 42	26 39	56
60	43 48	42 36	40 48	40 12	39 00	37 48	36 36	35 24	34 12	33 00	31 48	30 36	60
	″	″	″	″	″	″	″	″	″	″		″	
$\triangle_1 h$	0.73	0.71	0.68	0.67	0.65	0.63	0.61	0.59	0.57	0.55	0.53	0.51	$\triangle_1 h$
Log.	9.863 32	9.851 26	9.832 51	9.826 07	9.812 91	9.799 34	9.785 33	9.770 85	9.755 87	9.740 36	9.724 28	9.707 57	Log.
Limit	80	80	81	81	82	82	83	83	84	85	85	86	Minutes
Meridian	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	Altitudes

Latitude 45° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 32	0 32	0 33	0 34	0 35	0 35	0 36	0 36	0 37	0 38	0 39	4
8	2 05	2 08	2 10	2 13	2 15	2 17	2 20	2 24	2 26	2 29	2 32	2 37	8
12	4 43	4 48	4 52	4 58	5 03	5 09	5 15	5 23	5 29	5 35	5 43	5 52	12
16	8 21	8 32	8 40	8 50	9 01	9 11	9 21	9 33	9 43	9 57	10 09	10 24	16
20	13 04	13 20	13 32	13 48	14 04	14 20	14 36	14 56	15 12	15 32	15 52	16 16	20
24	18 49	19 12	19 29	19 52	20 16	20 39	21 02	21 30	21 53	22 22	22 51	23 25	24
28	25 37	26 08	26 32	27 03	27 34	28 05	28 37	29 16	29 48	30 27	31 06	31 53	28
32	33 27	34 08	34 39	35 20	36 00	36 41	37 22	38 14	38 55	39 46	40 37	41 39	32
36	42 20	43 12	43 51	44 43	45 35	46 27	47 19	48 23	49 15	50 20	51 25	52 42	36
40	52 16	53 20	54 08	55 12	56 16	57 20	58 24	59 44	60 48	62 08	63 28	65 04	40
44	63 14	64 32	65 30	66 48	68 05	69 23	70 40	72 16	73 34	75 11	76 48	78 43	44
48	75 16	76 48	77 57	79 29	81 01	82 33	84 05	86 01	87 33	89 28	91 23	93 42	48
52	88 20	90 08	91 29	93 17	95 05	96 53	98 41	100 57	102 45	105 00	107 15	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.96	2.00	2.03	2.07	2.11	2.15	2.19	2.24	2.28	2.33	2.38	2.44	$\triangle_1 h$
Log.	0.292 26	0.301 03	0.307 50	0.315 97	0.324 28	0.332 44	0.340 44	0.350 25	0.357 93	0.367 36	0.376 58	0.387 39	Log.
Limit	46	46	45	45	44	44	43	43	42	42	41	40	Minutes
Meridian	45°	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 39	0 41	0 42	0 43	0 44	0 45	0 46	0 47	0 49	0 51	0 52	0 54	4
8	2 40	2 43	2 47	2 51	2 56	3 01	3 06	3 11	3 18	3 24	3 31	3 39	8
12	5 59	6 07	6 17	6 26	6 36	6 47	6 59	7 11	7 35	9 39	7 54	8 11	12
16	10 37	10 53	11 11	11 26	11 44	12 05	12 25	12 45	13 11	13 37	14 02	14 33	16
20	16 36	17 00	17 28	17 52	18 20	18 52	19 24	19 56	20 36	21 16	21 56	22 44	20
24	23 54	24 29	25 10	25 44	26 24	27 10	27 56	28 42	29 40	30 38	31 35	32 44	24
28	32 33	33 19	34 14	35 01	35 56	36 59	38 02	39 05	40 23	41 41	43 00	44 34	28
32	42 30	43 31	44 42	45 44	46 56	48 18	49 40	51 02	52 44	54 26	56 09	58 12	32
36	53 47	55 05	56 36	57 54	59 24	61 08	62 51	64 35	66 45	68 55	71 04	73 39	36
40	66 24	68 00	69 52	71 28	73 20	75 28	77 36	79 44	82 24	85 04	87 44	90 56	40
44	80 20	82 17	84 33	86 29	88 44	...	...	...	...	...	...	...	44
48	95 37	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.49	2.55	2.62	2.68	2.75	2.83	2.91	2.99	3.09	3.19	3.29	3.41	$\triangle_1 h$
Log.	0.396 20	0.406 54	0.418 30	0.428 13	0.439 33	0.451 79	0.463 89	0.475 67	0.489 96	0.503 79	0.517 20	0.532 75	Log.
Limit	39	38	38	38	37	36	35	34	34	33	32	31	Minutes
Meridian	57°	58°	59°	60°	61°	62°	63°	64°	65°	66°	67°	68°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 57	0 59	1 02	1 04	1 07	1 10	1 15	1 18	1 23	1 30	1 36	1 45	4
8	3 47	3 55	4 05	4 16	4 29	4 43	4 57	5 14	5 35	5 58	6 26	6 59	8
12	8 30	8 50	9 11	9 36	10 05	10 35	11 09	11 49	12 33	13 26	14 28	15 43	12
16	15 06	15 42	16 21	17 04	17 55	18 49	19 51	20 59	22 19	23 54	25 44	27 57	16
20	23 36	24 32	25 32	26 40	28 00	29 24	31 00	32 48	34 52	37 20	40 12	43 40	20
24	33 59	35 20	36 46	38 24	40 19	42 20	44 39	47 14	50 12	53 46	57 54	62 53	24
28	46 15	48 05	50 03	52 16	54 53	57 38	60 45	64 18	68 21	...	...	...	28
32	60 25	62 48	65 22	68 16	71 41	...	...	...	...	...	...	...	32
36	76 28	79 30	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.54	3.68	3.83	4.00	4.20	4.41	4.65	4.92	5.23	5.60	6.03	6.55	$\triangle_1 h$
Log.	0.549	0.565	0.583	0.602	0.623	0.644	0.667	0.691	0.718	0.748	0.780	0.816	Log.
	00	85	20	06	25	44	45	97	50	19	32	24	
Limit	30	29	28	27	26	25	24	23	22	21	20	19	Minutes
Meridian	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 55	2 07	2 23	2 45	3 15	...	...	...	...	...	...	...	4
8	7 39	8 30	9 34	11 00	13 01	...	...	...	...	...	...	...	8
12	17 14	19 08	21 34	24 46	29 17	...	...	...	...	...	...	...	12
16	30 38	34 00	38 18	44 02	...	...	...	...	...	...	...	...	16
20	47 52	53 08	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	7.18	7.97	8.98	10.32	12.20	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.856	0.901	0.953	1.013	1.086	...	...	...	...	...	...	...	
	12	46	28	68	36	...	...	...	...	...	...	...	Log.
Limit	18	16	14	12	10	8	6	4	2	0	3	6	Minutes
Meridian	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	Altitudes

Latitude 45° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	2 44	2 14	1 52	1 36	1 23	1 14	1 05	0 59	0 53	0 48	4
8	...	...	10 56	8 54	7 29	6 24	5 34	4 54	4 21	3 53	3 30	3 09	8
12	...	...	24 35	20 02	16 49	14 24	12 32	11 01	9 46	8 44	7 52	7 07	12
16	...	...	43 41	35 38	29 55	25 36	22 16	19 35	17 22	15 32	13 57	12 37	16
20	...	...	...	...	46 44	40 00	34 48	30 36	27 08	24 16	21 48	19 44	20
24	...	...	...	...	...	...	50 07	44 04	39 04	34 57	31 23	28 25	24
28	...	...	...	...	...	...	...	...	53 11	47 33	42 44	38 41	28
32	...	...	...	...	...	...	...	...	...	...	55 49	50 31	32
36	...	...	...	...	...	...	...	...	...	...	...	63 56	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1h$	...	...	10.24	8.35	7.01	6.00	5.22	4.59	4.07	3.64	3.27	2.96	$\triangle_1h$
Log.	... ...	... ...	1.010 30	0.921 69	0.845 72	0.778 15	0.717 67	0.661 81	0.609 59	0.561 10	0.514 55	0.471 29	Log.
Limit	8	10	12	14	16	18	20	21	23	25	27	29	Minutes
Meridian	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 39	0 36	0 33	0 30	0 27	0 26	0 24	0 21	0 19	0 18	0 16	4
8	2 51	2 37	2 23	2 11	2 00	1 50	1 41	1 33	1 25	1 18	1 11	1 05	8
12	6 26	5 52	5 21	4 54	4 29	4 06	3 46	3 29	3 11	2 56	2 41	2 27	12
16	11 26	10 24	9 32	8 42	7 59	7 18	6 42	6 11	5 41	5 12	4 47	4 21	16
20	17 52	16 16	14 52	13 36	12 28	11 24	10 28	9 40	8 52	8 08	7 28	6 48	20
24	25 44	23 25	21 24	19 35	17 57	16 25	15 04	13 55	12 46	11 43	10 46	9 48	24
28	35 01	31 53	29 09	26 39	24 26	22 21	20 31	18 57	17 23	15 57	14 38	13 20	28
32	45 44	41 39	38 04	34 49	31 55	29 11	26 48	24 45	22 42	20 49	19 06	17 24	32
36	57 54	52 42	48 10	44 04	40 24	36 56	33 55	31 19	28 44	26 21	24 12	22 02	36
40	...	65 04	59 28	54 24	49 52	45 36	41 52	38 40	35 28	32 32	29 52	27 12	40
44	...	...	...	65 49	60 21	55 10	50 40	46 47	42 55	39 22	36 09	32 55	44
48	...	...	...	...	71 48	65 38	60 17	55 41	51 04	46 51	43 00	39 10	48
52	...	...	...	...	...	...	70 45	65 21	59 56	54 59	50 28	45 58	52
56	...	...	...	...	...	...	...	75 37	69 31	63 46	58 33	53 19	56
60	...	...	...	...	...	...	...	...	...	73 12	67 12	61 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1h$	2.68	2.44	2.23	2.04	1.87	1.71	1.57	1.45	1.33	1.22	1.12	1.02	$\triangle_1h$
Log.	0.428 13	0.387 39	0.348 30	0.309 63	0.271 84	0.233 00	0.195 90	0.161 37	0.123 85	0.086 36	0.049 22	0.008 60	Log.
Limit	31	33	35	37	39	41	43	45	47	49	52	55	Minutes
Meridian	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	64°	Altitudes

Latitude 45° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 30	0 30	0 30	0 30	0 29	0 28	0 28	0 27	0 27	0 27	0 27	4
8	2 05	2 03	2 01	2 00	1 58	1 56	1 54	1 52	1 50	1 49	1 47	1 45	8
12	4 43	4 38	4 34	4 29	4 25	4 20	4 17	4 12	4 08	4 05	4 00	3 56	12
16	8 21	8 14	8 06	7 59	7 51	7 44	7 35	7 28	7 20	7 15	7 08	7 00	16
20	13 04	12 52	12 40	12 28	12 16	12 04	11 52	11 40	11 28	11 20	11 08	10 56	20
24	18 49	18 31	18 14	17 57	17 40	17 23	17 05	16 48	16 31	16 19	16 02	15 45	24
28	25 37	25 14	24 50	24 26	24 02	23 39	23 16	22 52	22 29	22 13	21 49	21 25	28
32	33 27	32 57	32 26	31 55	31 24	30 53	30 23	29 52	29 21	29 01	28 30	27 59	32
36	42 20	41 41	41 02	40 24	39 45	39 06	38 27	37 48	37 09	36 43	36 05	35 26	36
40	52 16	51 28	50 40	49 52	49 04	48 16	47 28	46 40	45 52	45 20	44 32	43 44	40
44	63 14	62 16	61 18	60 21	59 22	58 24	57 26	56 28	55 30	54 51	53 54	52 55	44
48	75 16	74 07	72 58	71 48	70 39	69 30	68 19	67 10	66 01	65 15	64 07	62 58	48
52	88 20	86 59	85 38	84 16	82 55	81 34	80 13	78 52	77 31	76 37	75 15	73 54	52
56	102 26	100 52	99 18	97 45	96 10	94 36	93 02	91 28	89 54	88 51	87 18	85 43	56
60	. . .	. . .	114 00	112 12	110 24	108 36	106 48	105 00	103 12	102 00	100 12	98 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.96	1.93	1.90	1.87	1.84	1.81	1.78	1.75	1.72	1.70	1.67	1.64	$\Delta_1 h$
Log.	0.292 26	0.285 56	0.278 75	0.271 84	0.264 82	0.257 68	0.250 42	0.243 04	0.235 53	0.230 45	0.222 72	0.214 84	Log.
Limit	46	47	48	48	49	50	50	51	51	52	53	53	Minutes
Meridian	45°	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 26	0 26	0 25	0 25	0 24	0 24	0 23	0 23	0 22	0 22	0 22	0 22	4
8	1 43	1 42	1 41	1 39	1 38	1 36	1 35	1 34	1 33	1 31	1 30	1 28	8
12	3 53	3 50	3 46	3 43	3 40	3 36	3 34	3 31	3 28	3 25	3 22	3 19	12
16	6 55	6 50	6 42	6 37	6 32	6 24	6 18	6 13	6 08	6 03	5 58	5 53	16
20	10 48	10 40	10 28	10 20	10 12	10 00	9 52	9 44	9 36	9 28	9 20	9 12	20
24	15 34	15 22	15 04	14 53	14 41	14 24	14 12	14 01	13 49	13 38	13 26	13 15	24
28	21 10	20 54	20 31	20 15	20 00	19 36	19 21	19 05	18 49	18 34	18 18	18 02	28
32	27 38	27 18	26 48	26 27	26 07	25 36	25 16	24 55	24 35	24 14	23 54	23 33	32
36	35 00	34 34	33 55	33 29	33 03	32 24	31 58	31 32	31 06	30 40	30 14	29 49	36
40	43 12	42 40	41 52	41 20	40 48	40 00	39 28	38 56	38 24	37 52	37 20	36 48	40
44	52 17	51 38	50 40	50 01	49 22	48 24	47 45	47 06	46 27	45 49	45 10	44 32	44
48	62 12	61 26	60 17	29 31	58 45	57 36	56 50	56 04	55 18	54 32	53 46	52 59	48
52	73 00	72 06	70 45	69 51	68 57	67 36	66 42	65 48	64 54	64 00	63 06	62 11	52
56	84 41	83 38	82 04	81 01	79 58	78 24	77 21	76 18	75 15	74 13	73 10	72 08	56
60	97 12	96 00	94 12	93 00	91 48	90 00	88 48	87 36	86 24	85 12	84 00	82 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.62	1.60	1.57	1.55	1.53	1.50	1.48	1.46	1.44	1.42	1.40	1.38	$\Delta_1 h$
Log.	0.209 52	0.204 12	0.195 90	0.190 33	0.184 69	0.176 09	0.170 26	0.164 35	0.158 36	0.152 29	0.146 13	0.139 88	Log.
Limit	54	55	56	57	58	58	59	60	60	60	61	62	Minutes
Meridian	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	Altitudes

Latitude 45° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 21	0 21	0 20	0 20	0 20	0 19	0 19	0 19	0 19	0 19	4
8	1 27	1 26	1 24	1 23	1 22	1 21	1 20	1 18	1 18	1 16	1 15	1 13	8
12	3 16	3 13	3 10	3 07	3 05	3 02	2 59	2 56	2 54	2 51	2 48	2 45	12
16	5 48	5 43	5 38	5 33	5 27	5 22	5 17	5 12	5 10	5 05	5 00	4 55	16
20	9 04	8 56	8 48	8 40	8 32	8 24	8 16	8 08	8 04	7 56	7 48	7 40	20
24	13 04	12 52	12 41	12 29	12 17	12 06	11 54	11 43	11 37	11 26	11 14	10 03	24
28	17 46	17 30	17 15	16 59	16 44	16 28	16 12	15 57	15 49	15 33	15 17	15 01	28
32	23 12	22 52	22 31	22 11	21 51	21 30	21 10	20 49	20 39	20 18	19 58	19 37	32
36	29 23	28 57	28 31	28 05	27 39	27 13	26 47	26 21	26 08	25 43	25 17	24 51	36
40	36 16	35 44	35 12	34 40	34 08	33 36	33 04	32 32	32 16	31 44	31 12	30 40	40
44	43 53	43 14	42 36	41 57	41 18	40 38	40 00	39 22	39 02	38 24	37 46	37 07	44
48	52 13	51 27	50 41	49 55	49 09	48 23	47 37	46 51	46 28	45 41	44 55	44 09	48
52	61 17	60 23	59 29	58 35	57 41	56 47	55 53	54 59	54 32	53 37	52 43	51 49	52
56	71 05	70 02	69 00	67 57	66 54	65 51	64 48	63 46	63 14	62 12	61 10	60 07	56
60	81 36	80 24	79 12	78 00	76 48	75 36	74 24	73 12	72 36	71 24	70 62	69 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.36	1.34	1.32	1.30	1.28	1.26	1.24	1.22	1.205	1.19	1.17	1.15	$\triangle_1 h$
Log.	0.133 54	0.127 10	0.120 57	0.113 94	0.107 21	0.100 37	0.093 42	0.086 36	0.080 99	0.075 55	0.068 19	0.060 70	Log.
Limit	63	64	65	66	67	68	68	69	70	71	72	73	Minutes
Meridian	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 18	0 18	0 17	0 17	...	...	...	...	...	...	...	4
8	1 13	1 11	1 10	1 09	1 08	...	...	...	...	...	...	...	8
12	2 44	2 41	2 38	2 36	2 34	...	...	...	...	...	...	...	12
16	4 52	4 47	4 42	4 36	4 34	...	...	...	...	...	...	...	16
20	7 36	7 28	7 20	7 12	7 08	...	...	...	...	...	...	...	20
24	10 57	10 46	10 34	10 22	10 16	...	...	...	...	...	...	...	24
28	14 53	14 38	14 22	14 07	13 59	...	...	...	...	...	...	...	28
32	19 27	19 06	18 46	18 26	18 16	...	...	...	...	...	...	...	32
36	24 38	24 12	23 46	23 20	23 07	...	...	...	...	...	...	...	36
40	30 24	29 52	29 20	28 48	28 32	...	...	...	...	...	...	...	40
44	36 47	36 09	35 30	34 51	34 32	...	...	...	...	...	...	...	44
48	43 46	43 00	42 14	41 28	41 05	...	...	...	...	...	...	...	48
52	51 22	50 28	49 34	48 40	48 13	...	...	...	...	...	...	...	52
56	59 35	58 33	57 30	56 27	55 56	...	...	...	...	...	...	...	56
60	68 24	67 12	66 00	64 48	64 12	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.14	1.12	1.10	1.08	1.07	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.056 90	·0.049 22	0.041 39	0.033 42	0.029 38	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	74	75	76	77	78								Minutes
Meridian	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	0 14	0 14	0 14	0 14	0 14	0 13	0 12	0 12	0 12	0 12	4
8	...	...	0 57	0 56	0 55	0 54	0 53	0 52	0 51	0 50	0 49	0 48	8
12	...	...	2 10	2 07	2 04	2 01	1 59	1 56	1 54	1 51	1 50	1 47	12
16	...	...	3 50	3 45	3 40	3 35	3 33	3 28	3 22	3 17	3 14	3 09	16
20	...	...	6 00	5 52	5 44	5 36	5 32	5 24	5 16	5 08	5 04	4 56	20
24	...	...	8 38	8 27	8 16	8 04	7 58	7 47	7 35	7 23	7 18	7 06	24
28	...	...	11 46	11 30	11 14	10 58	10 51	10 35	10 20	10 04	9 56	9 40	28
32	...	...	15 22	15 01	14 40	14 20	14 10	13 49	13 29	13 09	12 58	12 38	32
36	...	...	19 26	19 01	18 35	18 09	17 56	17 30	17 04	16 38	16 25	15 59	36
40	...	...	24 00	23 28	22 56	22 24	22 08	21 36	21 04	20 32	20 16	19 44	40
44	...	...	29 02	28 24	27 45	27 06	26 47	26 08	25 29	24 51	24 31	23 52	44
48	...	...	34 34	33 47	33 01	32 15	31 52	31 06	30 18	29 32	29 09	28 23	48
52	...	...	40 34	39 39	38 45	37 51	37 24	36 30	35 36	34 42	34 15	33 21	52
56	...	...	47 02	46 00	44 57	43 54	43 23	42 20	41 17	40 15	39 44	38 40	56
60	...	...	54 00	52 48	51 36	50 24	49 48	48 36	47 24	46 12	45 36	44 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	0.90	0.88	0.86	0.84	0.83	0.81	0.79	0.77	0.76	0.74	$\Delta_1 h$
Log.	... ...	... ...	9.954 24	9.944 48	9.934 50	9.924 28	9.919 08	9.908 49	9.897 63	9.886 49	9.880 81	9.869 23	Log.
Limit			68	68	69	70	71	72	74	76	78	79	Minutes
Meridian	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	0 08	0 08	4
8	0 46	0 45	0 43	0 42	0 41	0 39	0 38	0 37	0 36	0 35	0 33	0 32	8
12	1 44	1 41	1 38	1 35	1 32	1 29	1 26	1 24	1 21	1 18	1 15	1 12	12
16	3 04	2 59	2 54	2 49	2 44	2 39	2 34	2 28	2 23	2 18	2 13	2 08	16
20	4 48	4 40	4 32	4 24	4 16	4 08	4 00	3 52	3 44	3 36	3 28	3 20	20
24	6 55	6 43	6 32	6 21	6 09	5 58	5 46	5 34	5 23	5 11	5 00	4 48	24
28	9 25	9 09	8 53	8 37	8 21	8 06	7 50	7 35	7 19	7 03	6 48	6 32	28
32	12 17	11 57	11 36	11 15	10 55	10 34	10 14	9 54	9 33	9 13	8 52	8 32	32
36	15 33	15 07	14 42	14 16	13 50	13 24	12 58	12 32	12 06	11 40	11 14	10 48	36
40	19 12	18 40	18 08	17 36	17 04	16 32	16 00	15 28	14 56	14 24	13 52	13 20	40
44	23 14	22 35	21 57	21 18	20 39	20 01	19 22	18 43	18 04	17 25	16 47	16 08	44
48	27 37	26 51	26 08	25 20	24 34	23 48	23 02	22 16	21 30	20 44	19 58	19 12	48
52	32 27	31 33	30 38	29 44	28 50	27 56	27 02	26 08	25 14	24 20	23 26	22 32	52
56	37 38	36 35	35 33	34 30	33 27	32 25	31 22	30 19	29 16	28 13	27 11	26 08	56
60	43 12	42 00	40 48	39 36	38 24	37 12	36 00	34 48	33 36	32 24	31 12	30 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.72	0.70	0.68	0.66	0.64	0.62	0.60	0.58	0.56	0.54	0.52	0.50	$\Delta_1 h$
Log.	9.857 33	9.845 10	9.832 51	9.819 54	9.806 18	9.792 39	9.778 15	9.763 43	9.748 19	9.732 39	9.716 00	9.698 97	Log.
Limit	79	80	80	81	81	82	82	83	83	84	84	85	Minutes
Meridian	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	Altitudes

Latitude 46° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 30	0 31	0 32	0 32	0 33	0 34	0 35	0 35	0 36	0 36	0 37	4
8	2 01	2 03	2 05	2 08	2 10	2 13	2 15	2 17	2 20	2 24	2 27	2 29	8
12	4 34	4 38	4 43	4 48	4 52	4 58	5 03	5 09	5 15	5 23	5 30	5 35	12
16	8 06	8 14	8 21	8 32	8 40	8 50	9 01	9 11	9 21	9 33	9 46	9 57	16
20	12 40	12 52	13 04	13 20	13 32	13 48	14 04	14 20	14 36	14 56	15 16	15 32	20
24	18 14	18 31	18 49	19 12	19 29	19 52	20 16	20 39	21 02	21 30	21 59	22 22	24
28	24 50	25 14	25 37	26 08	26 32	27 03	27 34	28 05	28 37	29 16	29 56	30 27	28
32	32 26	32 57	33 27	34 08	34 39	35 20	36 00	36 41	37 22	38 14	39 05	39 46	32
36	41 02	41 41	42 20	43 12	43 51	44 43	45 35	46 27	47 19	48 23	49 28	50 20	36
40	50 40	51 28	52 16	53 20	54 08	55 12	56 16	57 20	58 24	59 44	61 04	62 08	40
44	61 18	62 16	63 14	64 32	65 30	66 48	68 05	69 23	70 40	72 16	73 53	75 11	44
48	72 58	74 07	75 16	76 48	77 57	79 29	81 01	82 33	84 05	86 01	87 56	89 28	48
52	85 38	86 59	88 20	90 08	91 29	93 17	95 05	96 53	98 41	100 57	103 12	105 00	52
56	99 18	100 52	102 26	104 32	106 06	108 12	...	...	...	...	...	...	56
60	114 00	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.90	1.93	1.96	2.00	2.03	2.07	2.11	2.15	2.19	2.24	2.29	2.33	△₁h
Log.	0.278 75	0.285 56	0.292 26	0.301 03	0.307 50	0.315 97	0.324 28	0.332 44	0.340 44	0.350 25	0.359 84	0.367 36	Log.
Limit	47	47	46	45	45	45	44	44	43	42	42	41	Minutes
Meridian	44°	45°	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 39	0 40	0 41	0 42	0 43	0 44	0 46	0 46	0 48	0 50	0 51	4
8	2 33	2 37	2 40	2 44	2 47	2 52	2 57	3 02	3 06	3 13	3 19	3 26	8
12	5 44	5 52	6 00	6 09	6 17	6 27	6 38	6 49	7 01	7 13	7 27	7 42	12
16	10 12	10 24	10 40	10 55	11 11	11 29	11 46	12 07	12 27	12 51	13 17	13 42	16
20	15 56	16 16	16 40	17 04	17 28	17 56	18 24	18 56	19 28	20 04	20 44	21 24	20
24	22 57	23 25	24 00	24 35	25 10	25 50	26 30	27 16	28 02	28 54	29 52	30 49	24
28	31 14	31 53	32 40	33 27	34 14	35 09	36 04	37 06	38 10	39 20	40 38	41 57	28
32	40 47	41 39	42 40	43 41	44 42	45 54	47 06	48 28	49 50	51 22	53 04	54 47	32
36	51 38	52 42	54 00	55 18	56 36	58 07	59 37	61 21	63 04	65 01	67 11	69 20	36
40	63 44	65 04	66 40	68 16	69 52	71 44	73 36	75 44	77 52	80 16	82 56	85 36	40
44	77 07	78 43	80 40	82 36	84 33	86 48	...	...	...	...	...	...	44
48	91 46	93 42	96 00	...	...	...	...	...	...	...	...	...	48
52	107 42	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.39	2.44	2.50	2.56	2.62	2.69	2.76	2.84	2.92	3.01	3.11	3.21	△₁h
Log.	0.378 40	0.387 39	0.397 94	0.408 24	0.418 30	0.429 75	0.440 91	0.453 32	0.465 38	0 478 57	0.492 76	0.506 51	Log.
Limit	40	39	39	39	38	37	36	35	35	34	33	32	Minutes
Meridian	56°	57°	58°	59°	60°	61°	62°	63°	64°	65°	66°	67°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 54	0 55	0 57	1 00	1 02	1 05	1 08	1 12	1 17	1 21	1 27	1 34	4
8	3 33	3 41	3 49	3 59	4 09	4 21	4 35	4 49	5 06	5 25	5 49	6 15	8
12	7 59	8 14	8 36	8 57	9 22	9 48	10 18	10 51	11 29	12 12	14 04	14 04	12
16	14 13	14 43	15 16	15 55	16 38	17 24	18 18	19 17	20 23	21 40	23 12	25 00	16
20	22 12	23 00	23 52	24 52	26 00	27 12	28 36	30 08	31 52	33 52	36 16	39 04	20
24	31 58	33 07	34 22	35 48	37 26	39 10	41 11	43 24	45 53	48 46	52 13	56 16	24
28	43 31	45 05	46 47	48 45	50 58	53 19	56 04	59 04	62 26	66 23	...	...	28
32	56 30	58 53	61 06	63 40	66 34	69 38	73 13	...	...	...	...	...	32
36	71 56	74 31	77 20	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.33	3.45	3.58	3.73	3.90	4.08	4.29	4.52	4.78	5.08	5.44	5.86	$\triangle_1 h$
Log.	0.522 44	0.537 82	0.553 88	0.571 71	0.591 06	0.610 66	0.632 46	0.655 14	0.679 43	0.705 86	0.735 60	0.767 90	Log.
Limit	31	30	29	28	27	26	25	24	23	22	21	20	Minutes
Meridian	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 42	1 51	2 03	2 19	2 40	3 09	...	...	...	...	...	...	4
8	6 47	7 25	8 14	9 17	10 40	12 35	...	...	...	...	...	...	8
12	15 16	16 43	18 32	20 53	24 00	28 19	...	...	...	...	...	...	12
16	27 08	29 41	32 56	37 07	42 40	...	...	...	...	...	...	...	16
20	42 00	46 24	51 28	58 00	...	...	...	...	...	...	...	...	20
24	61 04	66 49	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.36	6.96	7.72	8.70	10.00	11.80	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.803 46	0.842 61	0.887 62	0.939 52	1.00 ...	1.071 88	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	19	18	17	15	13	11	9	7	5	3	0	3	Minutes
Meridian	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	Altitudes

Latitude 46° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	2 38	2 08	1 48	1 32	1 20	1 10	1 02	0 55	0 50	4
8	...	...	...	10 30	8 34	7 12	6 09	5 20	4 41	4 09	3 43	3 19	8
12	...	...	...	23 38	19 14	16 11	13 50	12 00	10 32	9 20	8 22	7 29	12
16	...	...	...	...	34 16	28 45	24 34	21 20	18 44	16 36	14 50	13 19	16
20	...	...	...	...	...	44 56	38 24	33 20	29 16	25 56	23 12	20 48	20
24	...	...	...	...	...	...	...	48 00	42 09	37 21	33 24	29 58	24
28	...	...	...	...	...	...	...	...	...	50 20	45 29	40 46	28
32	...	...	...	...	...	...	...	...	...	...	59 24	53 14	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	9.85	8.03	6.74	5.76	5.00	4.39	3.89	3.48	3.12	$\triangle_1$h
Log.	... ...	... ...	... ...	0.993 44	0.904 72	0.828 66	0.760 42	0.698 97	0.642 46	0.589 95	0.541 58	0.494 15	Log.
Limit	6	8	10	12	14	16	18	20	22	24	26	28	Minutes
Meridian	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	″ ′	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 45	0 41	0 37	0 34	0 30	0 28	0 26	0 24	0 22	0 20	0 19	0 17	4
8	3 00	2 44	2 28	2 15	2 03	1 54	1 43	1 36	1 27	1 20	1 13	1 07	8
12	6 46	6 09	5 34	5 05	4 38	4 15	3 53	3 35	3 16	3 00	2 45	2 31	12
16	12 02	10 55	9 54	9 03	8 14	7 33	6 55	6 21	5 48	5 20	4 55	4 29	16
20	18 48	17 04	15 28	14 08	12 52	11 48	10 48	9 56	9 04	8 20	7 40	7 00	20
24	27 05	24 35	22 17	20 22	18 31	16 59	15 34	14 18	13 04	12 00	11 03	10 05	24
28	36 51	33 27	30 19	27 42	25 14	23 08	21 10	19 29	17 46	16 20	15 01	13 43	28
32	48 07	43 41	39 35	36 10	32 51	30 13	27 38	25 26	23 12	21 20	19 37	17 55	32
36	60 55	55 18	50 07	45 48	41 41	38 14	35 00	32 11	29 33	27 00	24 51	22 41	36
40	...	...	61 52	56 32	51 28	47 12	43 12	39 44	36 16	33 20	30 40	28 00	40
44	...	...	...	68 25	62 16	57 07	52 17	48 04	43 53	40 20	37 07	33 53	44
48	...	...	...	...	...	67 56	62 12	57 13	52 13	48 00	44 09	40 19	48
52	...	...	...	...	...	...	...	69 09	61 17	56 20	51 49	47 19	52
56	...	...	...	...	...	...	...	...	71 05	65 20	60 07	54 53	56
60	...	...	...	...	...	...	...	...	...	75 00	69 00	63 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.82	2.56	2.32	2.12	1.93	1.77	1.62	1.49	1.36	1.25	1.15	1.05	$\triangle_1$h
Log.	0.450 25	0.408 24	0.365 49	0.326 34	0.285 56	0.247 97	0.209 52	0.173 19	0.133 54	0.096 91	0.060 70	0.021 19	Log.
Limit	30	32	34	36	38	40	42	44	46	48	51	54	Minutes
Meridian	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	65°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 30	0 29	0 29	0 28	0 28	0 27	0 27	0 27	0 27	0 26	0 26	4
8	2 01	1 59	1 57	1 55	1 54	1 52	1 50	1 49	1 47	1 45	1 43	1 42	8
12	4 34	4 28	4 23	4 19	4 17	4 12	4 08	4 05	4 00	3 56	3 53	3 50	12
16	8 06	7 56	7 49	7 41	7 35	7 28	7 20	7 15	7 08	7 00	6 55	6 50	16
20	12 40	12 24	12 12	12 00	11 52	11 40	11 28	11 20	11 08	10 56	10 48	10 40	20
24	18 14	17 52	17 34	17 17	17 05	16 48	16 31	16 19	16 02	15 45	15 34	15 22	24
28	24 50	24 18	23 55	23 31	23 16	22 52	22 29	22 13	21 49	21 25	21 10	20 54	28
32	32 26	31 44	31 13	30 43	30 23	29 52	29 21	29 01	28 30	27 59	27 38	27 18	32
36	41 02	40 11	39 22	38 53	38 27	37 48	37 09	36 43	36 05	35 26	35 00	34 34	36
40	50 40	49 36	48 48	48 00	47 28	46 40	45 52	45 20	44 32	43 44	43 12	42 40	40
44	61 18	60 01	59 03	58 05	57 26	56 28	55 30	54 51	53 54	52 55	52 17	51 38	44
48	72 58	71 25	70 16	69 07	68 19	67 10	66 01	65 15	64 07	62 58	62 12	61 26	48
52	85 38	83 49	82 28	81 07	80 13	78 52	77 31	76 37	75 15	73 54	73 00	72 06	52
56	99 18	97 13	95 39	94 05	93 02	91 28	89 54	88 51	87 18	85 43	84 41	83 38	56
60	114 00	111 36	109 48	108 00	106 48	105 00	103 12	102 00	100 12	98 24	97 12	96 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.90	1.86	1.83	1.80	1.78	1.75	1.72	1.70	1.67	1.64	1.62	1.60	$\triangle_1 h$
Log.	0.278 75	0.269 51	0.262 45	0.255 27	0.250 42	0.243 04	0.235 53	0.230 45	0.222 72	0.214 84	0.209 52	0.204 12	Log.
Limit	47	48	49	49	50	50	51	52	52	53	54	54	Minutes
Meridian	44°	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 25	0 24	0 24	0 23	0 23	0 22	0 22	0 22	0 22	0 22	0 22	4
8	1 41	1 39	1 38	1 36	1 35	1 34	1 33	1 31	1 30	1 28	1 27	1 26	8
12	3 46	3 43	3 40	3 37	3 34	3 31	3 28	3 25	3 22	3 19	3 16	3 13	12
16	6 42	6 37	6 32	6 27	6 18	6 13	6 08	6 03	5 58	5 53	5 48	5 43	16
20	10 28	10 20	10 12	10 04	9 52	9 44	9 36	9 28	9 20	9 12	9 04	8 56	20
24	15 04	14 53	14 41	14 30	14 12	14 01	13 49	13 38	13 26	13 15	13 04	12 52	24
28	20 31	20 15	20 00	19 44	19 21	19 05	18 49	18 34	18 18	18 02	17 46	17 30	28
32	26 48	26 27	26 07	25 46	25 16	24 55	24 35	24 14	23 54	23 33	23 12	22 52	32
36	33 55	33 29	33 03	32 37	31 58	31 32	31 06	30 40	30 14	29 49	29 23	28 57	36
40	41 52	41 20	40 48	40 16	39 28	38 56	38 24	37 52	37 20	36 48	36 16	38 44	40
44	50 40	50 01	49 22	48 43	47 45	47 06	46 27	45 49	45 10	44 32	43 53	43 14	44
48	60 17	59 31	58 45	57 59	56 50	56 04	55 18	54 32	53 46	52 59	52 13	51 27	48
52	70 45	69 51	68 57	68 03	66 42	65 48	64 54	64 00	63 06	62 11	61 17	60 23	52
56	82 04	81 01	79 58	78 55	77 21	76 18	75 15	74 13	73 10	72 08	71 05	70 02	56
60	94 12	93 00	91 48	90 36	88 48	87 36	86 24	85 12	84 00	82 48	81 36	80 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.57	1.55	1.53	1.51	1.48	1.46	1.44	1.42	1.40	1.38	1.36	1.34	$\triangle_1 h$
Log.	0.195 90	0.190 33	0.184 69	0.178 98	0.170 26	0.164 35	0.158 36	0.152 29	0.146 13	0.139 88	0.133 54	0.127 10	Log.
Limit	55	56	57	58	58	58	59	60	61	61	62	63	Minutes
Meridian	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	Altitudes

Latitude 46° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min
4	0 21	0 21	0 20	0 20	0 20	0 19	0 19	0 19	0 19	0 19	0 19	0 18	4
8	1 24	1 23	1 23	1 22	1 20	1 19	1 18	1 17	1 15	1 15	1 13	1 12	8
12	3 10	3 07	3 06	3 03	3 00	2 57	2 54	2 53	2 50	2 48	2 45	2 42	12
16	5 38	5 33	5 30	5 25	5 20	5 15	5 10	5 07	5 02	5 00	4 55	4 50	16
20	8 48	8 40	8 36	8 28	8 20	8 12	8 04	8 00	7 52	7 48	7 40	7 32	20
24	12 41	12 29	12 23	12 11	12 00	11 48	11 37	11 31	11 20	11 14	11 03	10 51	24
28	17 15	16 59	16 52	16 36	16 20	16 05	15 49	15 41	15 25	15 17	15 01	14 46	28
32	22 31	22 11	22 01	21 41	21 20	21 00	20 39	20 29	20 08	19 58	19 37	19 17	32
36	28 31	28 05	27 52	27 26	27 00	26 34	26 08	25 55	25 30	25 17	24 51	24 25	36
40	35 12	34 40	34 24	33 52	33 20	32 48	32 16	32 00	31 28	31 12	30 40	30 08	40
44	42 36	41 57	41 37	40 59	40 20	39 41	39 02	38 43	38 05	37 46	37 07	36 28	44
48	50 41	49 55	49 32	48 45	48 00	47 14	46 28	46 05	45 18	44 55	44 09	43 23	48
52	59 29	58 35	58 08	57 14	56 20	55 26	54 32	54 05	53 10	52 43	51 49	50 55	52
56	69 00	67 57	67 25	66 23	65 20	64 17	63 14	62 43	61 41	61 10	60 07	59 04	56
60	79 12	78 00	77 24	76 12	75 00	73 48	72 36	72 00	70 48	70 12	69 00	67 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.32	1.30	1.29	1.27	1.25	1.23	1.21	1.20	1.18	1.17	1.15	1.13	$\Delta_1 h$
Log.	0.120 57	0.113 94	0.110 59	0.103 80	0.096 91	0.089 91	0.082 79	0.079 18	0.071 88	0.068 19	0.060 70	0.053 08	Log.
Limit	64	65	66	67	68	69	69	70	71	72	73	74	Minutes
Meridian	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 18	0 17	0 17	...	...	...	...	...	...	...	...	4
8	1 11	1 10	1 09	1 08	...	...	...	...	...	...	...	...	8
12	2 41	2 38	2 36	2 33	...	...	...	...	...	...	...	...	12
16	4 47	4 42	4 36	4 31	...	...	...	...	...	...	...	...	16
20	7 28	7 20	7 12	7 04	...	...	...	...	...	...	...	...	20
24	10 46	10 34	10 22	10 11	...	...	...	...	...	...	...	...	24
28	14 38	14 22	14 07	13 51	...	...	...	...	...	...	...	...	28
32	19 06	18 46	18 26	18 05	...	...	...	...	...	...	...	...	32
36	24 12	23 46	23 20	22 54	...	...	...	...	...	...	...	...	36
40	29 52	29 20	28 48	28 16	...	...	...	...	...	...	...	...	40
44	36 09	35 30	34 51	34 12	...	...	...	...	...	...	...	...	44
48	43 00	42 14	41 28	40 42	...	...	...	...	...	...	...	...	48
52	50 28	49 34	48 40	47 46	...	...	...	...	...	...	...	...	52
56	58 33	57 30	56 27	55 24	...	...	...	...	...	...	...	...	56
60	67 12	66 00	64 48	63 36	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.12	1.10	1.08	1.06	...	...	...	...	...	...	...	...	$\Delta_1 h$
Log.	0.049 22	0.041 39	0.033 42	0.025 31	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	75	76	77	78									Minutes
Meridian	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	Altitudes

Latitude 46° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	0 14	0 14	0 14	0 14	0 13	0 13	0 12	0 12	0 12	0 12	0 11	4
8	...	0 57	0 56	0 55	0 54	0 53	0 52	0 51	0 50	0 49	0 48	0 47	8
12	...	2 10	2 07	2 04	2 02	1 59	1 56	1 54	1 53	1 50	1 48	1 45	12
16	...	3 50	3 45	3 40	3 38	3 33	3 28	3 22	3 19	3 14	3 12	3 07	16
20	...	6 00	5 52	5 44	5 40	5 32	5 24	5 16	5 12	5 04	5 00	4 52	20
24	...	8 38	8 27	8 16	8 10	7 58	7 47	7 35	7 29	7 18	7 12	7 00	24
28	...	11 46	11 30	11 14	11 06	10 51	10 35	10 20	10 12	9 56	9 48	9 33	28
32	...	15 22	15 01	14 40	14 30	14 10	13 49	13 29	13 19	12 58	12 48	12 28	32
36	...	19 26	19 01	18 35	18 22	17 56	17 30	17 04	16 51	16 25	16 12	15 46	36
40	...	24 00	23 28	22 56	22 40	22 08	21 36	21 04	20 48	20 16	20 00	19 28	40
44	...	29 02	28 24	27 45	27 26	26 47	26 08	25 29	25 10	24 31	24 12	23 33	44
48	...	34 34	33 47	33 01	32 38	31 52	31 06	30 18	29 55	29 09	28 46	28 00	48
52	...	40 34	39 39	38 45	38 18	37 24	36 30	35 36	35 09	34 15	33 48	32 54	52
56	...	47 02	46 00	44 57	44 26	43 23	42 20	41 17	40 46	39 44	39 12	38 09	56
60	...	54 00	52 48	51 36	51 00	49 48	48 36	47 24	46 48	45 36	45 00	43 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	0.90	0.88	0.86	0.85	0.83	0.81	0.79	0.78	0.76	0.75	0.73	$\triangle_1 h$
Log.	... ...	9.954 24	9.944 48	9.934 50	9.929 42	9.919 08	9.908 49	9.897 63	9.892 09	9.880 81	9.875 06	9.863 32	Log.
Limit		68	67	67	68	69	70	71	73	75	77	78	Minutes
Meridian	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	0 08	0 08	4
8	0 46	0 44	0 43	0 41	0 41	0 39	0 38	0 37	0 36	0 35	0 33	0 32	8
12	1 42	1 39	1 36	1 33	1 32	1 29	1 26	1 24	1 21	1 18	1 15	1 12	12
16	3 02	2 57	2 52	2 47	2 44	2 39	2 34	2 28	2 23	2 18	2 13	2 08	16
20	4 44	4 36	4 28	4 20	4 16	4 08	4 00	3 52	3 44	3 36	3 28	3 20	20
24	6 49	6 38	6 26	6 15	6 09	5 58	5 46	5 34	5 23	5 11	5 00	4 48	24
28	9 17	9 01	8 45	8 29	8 21	8 06	7 50	7 35	7 19	7 03	6 48	6 32	28
32	12 07	11 46	11 26	11 05	10 55	10 34	10 14	9 54	9 33	9 13	8 52	8 32	32
36	15 20	14 55	14 29	14 03	13 50	13 24	12 58	12 32	12 06	11 40	11 14	10 48	36
40	18 56	18 24	17 52	17 20	17 04	16 32	16 00	15 28	14 56	13 24	13 52	13 20	40
44	22 54	22 16	21 38	20 59	20 39	20 01	19 22	18 43	18 04	17 25	16 47	16 08	44
48	27 14	26 29	25 43	24 57	24 34	23 48	23 02	22 16	21 30	20 44	19 58	19 12	48
52	32 00	31 05	30 11	29 17	28 50	27 56	27 02	26 08	25 14	24 20	23 26	22 32	52
56	37 07	36 04	35 02	33 59	33 27	32 25	31 22	30 19	29 16	28 13	27 11	26 08	56
60	42 36	41 24	40 12	39 00	38 24	37 12	36 00	34 48	33 36	32 24	31 12	30 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.71	0.69	0.67	0.65	0.64	0.62	0.60	0.58	0.56	0.54	0.52	0.50	$\triangle_1 h$
Log.	9.851 26	9.838 85	9.826 07	9.812 91	7.806 18	9.792 39	9.778 15	9.763 43	9.748 19	9.732 39	9.716 00	9.698 97	Log.
Limit	78	79	79	80	81	81	82	82	83	83	84	84	Minutes
Meridian	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 29	0 30	0 30	0 30	0 31	0 31	0 32	0 33	0 34	0 35	0 35	0 36	4
8	1 57	1 59	2 01	2 03	2 05	2 07	2 10	2 13	2 15	2 17	2 20	2 24	8
12	4 23	4 28	4 32	4 38	4 43	4 47	4 52	4 58	5 03	5 09	5 15	5 23	12
16	7 49	7 56	8 04	8 14	8 21	8 29	8 40	8 50	9 01	9 11	9 21	9 33	16
20	12 12	12 24	12 36	12 52	13 04	13 16	13 32	13 48	14 04	14 20	14 36	14 56	20
24	17 34	17 52	18 09	18 31	18 49	19 06	19 29	19 52	20 16	20 39	21 02	21 30	24
28	23 55	24 18	24 42	25 14	25 37	26 01	26 32	27 03	27 34	28 05	28 37	29 16	28
32	31 13	31 44	32 15	32 57	33 27	33 58	34 39	35 20	36 00	36 41	37 22	38 14	32
36	39 32	40 11	40 50	41 41	42 20	42 59	43 51	44 43	45 35	46 27	47 19	48 23	36
40	48 48	49 36	50 24	51 28	52 16	53 04	54 08	55 12	56 16	57 20	58 24	59 44	40
44	59 03	60 01	60 59	62 16	63 14	64 12	65 30	66 48	68 05	69 23	70 40	72 16	44
48	70 16	71 25	72 34	74 07	75 16	76 25	77 57	79 29	81 01	82 33	84 05	86 01	48
52	82 28	83 49	85 10	86 59	88 20	89 41	91 29	93 17	95 05	96 53	98 41	100 57	52
56	95 39	97 13	98 47	100 52	102 26	104 00	...	...	...	...	...	...	56
60	109 48	111 36	113 24	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.83	1.86	1.89	1.93	1.96	1.99	2.03	2.07	2.11	2.15	2.19	2.24	Δ_1h
Log.	0.262 45	0.269 51	0.276 46	0.285 56	0.292 26	0.298 85	0.307 50	0.315 97	0.324 28	0.332 44	0.340 44	0.350 25	Log.
Limit	48	47	47	46	46	46	45	45	44	44	43	42	Minutes
Meridian	43°	44°	45°	46°	47°	48°	49°	50°	51°	52°	53°	54°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 36	0 37	0 38	0 39	0 40	0 41	0 42	0 43	0 44	0 46	0 47	0 48	4
8	2 26	2 39	2 33	2 37	2 40	2 44	2 48	2 52	2 58	3 02	3 08	3 14	8
12	5 29	5 35	5 44	5 52	6 00	6 09	6 18	6 27	6 39	6 50	7 04	7 16	12
16	9 43	9 57	10 12	10 24	10 40	10 55	11 14	11 29	11 49	12 10	12 32	12 56	16
20	15 12	15 32	15 56	16 16	16 40	17 04	17 32	17 56	18 28	19 00	19 36	20 12	20
24	21 53	22 22	22 57	23 25	24 00	24 35	25 15	25 50	26 35	27 22	28 13	29 05	24
28	29 48	30 27	31 14	31 53	32 40	33 27	34 22	35 09	36 12	37 14	38 25	39 36	28
32	38 55	39 46	40 47	41 39	42 40	43 41	44 53	45 54	47 17	48 38	50 11	51 43	32
36	49 15	50 20	51 38	52 42	54 00	55 18	56 49	58 07	59 50	61 34	63 30	65 27	36
40	60 48	62 08	63 44	65 04	66 40	68 16	70 08	71 44	73 52	76 00	78 24	80 48	40
44	73 34	75 11	77 07	78 43	80 40	82 36	84 52	86 48	...	...	...	...	44
48	87 33	89 28	91 46	93 42	96 00	...	...	...	...	...	...	...	48
52	102 45	105 00	107 42	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	2.28	2.33	2.39	2.44	2.50	2.56	2.63	2.69	2.77	2.85	2.94	3.03	Δ_1h
Log.	0.357 93	0.367 36	0.378 40	0.387 39	0.397 94	0.408 24	0.419 96	0.429 75	0.442 48	0.454 84	0.468 35	0.481 44	Log.
Limit	41	40	40	40	39	38	37	36	36	35	34	33	Minutes
Meridian	55°	56°	57°	58°	59°	60°	61°	62°	63°	64°	65°	66°	Altitudes

Latitude 47° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 51	0 52	0 54	0 55	0 59	1 00	1 03	1 07	1 10	1 15	1 19	1 25	4
8	3 20	3 28	3 35	3 44	3 52	4 03	4 14	4 28	4 41	4 57	5 15	5 38	8
12	7 30	7 48	8 04	8 23	8 42	9 06	9 32	9 59	10 32	11 08	11 50	12 41	12
16	13 22	13 52	14 20	14 53	15 30	16 10	16 56	17 45	18 44	19 48	21 02	22 31	16
20	20 52	21 40	22 24	23 16	24 12	25 16	26 28	27 44	29 16	30 56	32 52	35 12	20
24	30 03	31 12	32 16	33 30	34 51	36 23	38 06	39 57	42 09	44 33	47 19	50 41	24
28	40 54	42 28	43 54	45 37	47 26	49 32	51 53	57 22	57 22	60 37	64 26	69 00	28
32	53 25	55 28	57 20	59 34	61 57	64 41	67 46	74 55	...	...	...	...	32
36	67 37	70 12	72 35	75 23	...	...	...	...	...	...	...	...	36
40	83 28	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.13	3.25	3.36	3.49	3.63	3.79	3.97	4.16	4.39	4.64	4.93	5.28	$\triangle_1 h$
Log.	0.495 54	0.511 88	0.526 34	0.542 83	0.559 91	0.578 64	0.598 79	0.619 09	0.642 46	0.666 52	0.692 85	0.722 63	Log.
Limit	32	31	30	29	28	27	26	26	25	24	23	22	Minutes
Meridian	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 31	1 39	1 49	1 59	2 14	2 35	3 02	...	...	...	...	...	4
8	6 03	6 34	7 12	7 59	8 59	10 19	12 11	...	...	...	...	...	8
12	13 38	14 47	16 12	17 56	20 13	23 12	27 23	...	...	...	...	...	12
16	24 14	26 17	28 48	31 52	35 55	41 16	...	...	...	...	...	...	16
20	37 52	41 04	45 00	49 48	56 08	...	...	...	...	...	...	...	20
24	54 32	59 09	64 48	...	...	...	...	...	...	...	...	...	24
28	74 13	80 29	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.68	6.16	6.75	7.47	8.42	9.67	11.41	...	...	...	...	...	$\triangle_1 h$
Log.	0.754 35	0.789 58	0.829 30	0.873 32	0.925 31	0.985 43	1.057 29	... ...	... ...	... ...	... ...	... ...	Log.
Limit	21	20	19	17	15	13	11	9	7	5	3	0	Minutes
Meridian	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	Altitudes

Latitude 47° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	2 31	2 03	1 43	1 28	1 16	1 07	0 59	0 53	4
8	...	...	...	...	10 06	8 14	6 54	5 53	5 07	4 29	3 58	3 32	8
12	...	...	...	...	22 43	18 30	15 31	13 15	11 30	10 05	8 56	7 58	12
16	...	...	...	...	...	32 54	27 33	23 33	20 26	17 55	15 52	14 10	16
20	...	...	...	...	...	...	43 04	36 48	31 56	28 00	24 48	22 08	20
24	...	...	...	...	...	...	...	...	45 59	40 19	35 43	31 53	24
28	...	...	...	...	...	...	...	...	...	54 53	48 37	43 23	28
32	...	...	...	...	...	...	...	...	...	...	...	56 39	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	9.46	7.71	6.46	5.52	4.79	4.20	3.72	3.32	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	0.975 89	0.887 05	0.810 23	0.741 94	0.680 34	0.623 25	0.570 54	0.521 14	Log.
Limit	4	6	8	10	12	14	16	18	20	22	24	26	Minutes
Meridian	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 47	0 43	0 39	0 35	0 32	0 30	0 27	0 25	0 22	0 20	0 19	0 17	4
8	3 10	2 51	2 36	2 22	2 09	1 57	1 47	1 39	1 30	1 22	1 15	1 08	8
12	7 10	6 26	5 50	5 18	4 49	4 23	4 00	3 42	3 22	3 05	2 48	2 33	12
16	12 42	11 26	10 22	9 26	8 35	7 49	7 08	6 34	5 58	5 27	5 00	4 31	16
20	19 52	17 52	16 12	14 44	13 24	12 12	11 08	10 16	9 20	8 32	7 48	7 04	20
24	28 36	25 44	23 19	21 13	19 18	17 34	16 02	14 47	13 26	12 17	11 14	10 11	24
28	38 57	35 01	31 46	28 53	26 16	23 55	21 49	20 07	18 18	16 44	15 17	13 51	28
32	50 52	45 44	41 29	37 43	34 18	31 14	28 30	26 17	23 54	21 51	19 58	18 05	32
36	64 22	57 54	52 29	47 44	43 25	39 32	36 05	33 16	30 14	27 39	25 17	22 54	36
40	...	...	64 48	58 56	53 36	48 48	44 32	41 04	37 20	34 08	31 12	28 16	40
44	...	...	...	71 18	64 51	59 03	53 54	49 41	45 10	41 18	37 46	34 12	44
48	...	...	...	...	...	...	64 07	59 08	53 46	49 09	44 55	40 42	48
52	...	...	...	...	...	...	...	69 24	63 06	57 41	52 43	47 46	52
56	...	...	...	...	...	...	...	...	...	66 54	61 10	55 24	56
60	...	...	...	...	...	...	...	...	...	...	70 12	63 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.98	2.68	2.43	2.21	2.01	1.83	1.67	1.54	1.40	1.28	1.17	1.06	$\triangle_1$h
Log.	0.474 22	0.428 13	0.385 61	0.344 39	0.303 20	0.262 45	0.222 72	0.187 52	0.146 13	0.107 21	0.068 19	0.025 31	Log.
Limit	29	31	33	35	37	38	40	42	45	47	50	53	Minutes
Meridian	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	66°	Altitudes

Latitude 47° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 29	0 29	0 28	0 28	0 27	0 27	0 27	0 27	0 26	0 26	0 25	0 25	4
8	1 57	1 55	1 54	1 52	1 50	1 48	1 47	1 45	1 43	1 42	1 41	1 39	8
12	4 23	4 19	4 16	4 12	4 08	4 03	4 00	3 56	3 53	3 50	3 46	3 43	12
16	7 49	7 41	7 33	7 28	7 20	7 13	7 08	7 00	6 55	6 50	6 42	6 37	16
20	12 12	12 00	11 48	11 40	11 28	11 16	11 08	10 56	10 48	10 40	10 28	10 20	20
24	17 34	17 17	16 59	16 48	16 31	16 14	16 02	15 45	15 34	15 22	15 04	14 53	24
28	23 55	23 31	23 08	22 52	22 29	22 05	21 49	21 25	21 10	20 54	20 31	20 15	28
32	31 13	30 43	30 13	29 52	29 21	28 50	28 30	27 59	27 38	27 18	26 48	26 27	32
36	39 32	38 53	38 14	37 48	37 09	36 31	36 05	35 26	35 00	34 34	33 55	33 29	36
40	48 48	48 00	47 12	46 40	45 32	45 04	44 32	43 44	43 12	42 40	41 52	41 20	40
44	59 03	58 05	57 07	56 28	55 30	54 32	53 54	52 55	52 17	51 38	50 40	50 01	44
48	70 16	69 07	67 56	67 10	66 01	64 53	64 07	62 58	62 12	61 26	60 17	59 31	48
52	82 28	81 07	79 46	78 52	77 31	76 09	75 15	73 54	73 00	72 06	70 45	69 51	52
56	95 39	94 05	92 31	91 28	89 54	88 20	87 18	85 43	84 41	83 38	82 04	81 01	56
60	109 48	108 00	106 12	105 00	103 12	101 24	100 12	98 24	97 12	96 00	94 12	93 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.83	1.80	1.77	1.75	1.72	1.69	1.67	1.64	1.62	1.60	1.57	1.55	$\Delta_1 h$
Log.	0.262 45	0.255 27	0.247 97	0.243 04	0.235 53	0.227 89	0.222 72	0.214 84	0.209 52	0.204 12	0.195 90	0.190 33	Log.
Limit	48	49	50	50	51	51	52	53	53	54	55	56	Minutes
Meridian	43°	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 24	0 24	0 23	0 23	0 22	0 22	0 22	0 22	0 22	0 22	0 21	0 21	4
8	1 38	1 36	1 36	1 34	1 33	1 31	1 30	1 29	1 28	1 26	1 25	1 23	8
12	3 40	3 37	3 35	3 31	3 28	3 25	3 22	3 20	3 17	3 14	3 11	3 08	12
16	6 32	6 27	6 21	6 13	6 08	6 03	5 58	5 56	5 51	5 46	5 41	5 36	16
20	10 12	10 04	9 56	9 44	9 36	9 28	9 20	9 16	9 08	9 00	8 52	8 44	20
24	14 41	14 30	14 18	14 01	13 49	13 38	13 26	13 21	13 09	12 58	12 46	12 35	24
28	20 00	19 44	19 29	19 05	18 49	18 34	18 18	18 10	17 54	17 38	17 23	17 07	28
32	26 07	25 46	25 26	24 55	24 35	24 14	23 54	23 43	23 23	23 02	22 42	22 21	32
36	33 03	32 37	32 11	31 32	31 06	30 40	30 14	30 02	29 36	29 10	28 44	28 18	36
40	40 48	40 16	39 44	38 56	38 24	37 52	37 20	37 04	36 32	36 00	35 28	34 56	40
44	49 22	48 43	48 04	47 06	46 27	45 49	45 10	44 51	44 13	43 34	42 55	42 16	44
48	58 45	57 59	57 13	56 04	55 18	54 32	53 46	53 22	52 36	51 50	51 04	50 18	48
52	68 57	68 03	67 09	65 48	64 54	64 00	63 06	62 38	61 44	60 50	59 56	59 02	52
56	79 58	78 55	77 52	76 18	75 15	74 13	73 10	72 39	71 37	70 34	69 31	68 28	56
60	91 48	90 36	89 24	87 36	86 24	85 12	84 00	83 24	82 12	81 00	79 48	78 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.53	1.51	1.49	1.46	1.44	1.42	1.40	1.39	1.37	1.35	1.33	1.31	$\Delta_1 h$
Log.	0.184 69	0.178 98	0.173 19	0.164 35	0.158 36	0.152 29	0.146 13	0.143 01	0.136 72	0.130 33	0.123 85	0.117 27	Log.
Limit	57	58	59	59	59	60	60	61	62	62	63	64	Minutes
Meridian	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	Altitudes

Latitude 47° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 20	0 20	0 20	0 19	0 19	0 19	0 19	0 19	0 19	0 18	0 18	4
8	1 23	1 21	1 21	1 20	1 18	1 17	1 16	1 15	1 14	1 13	1 11	1 11	8
12	3 06	3 03	3 02	2 59	2 56	2 53	2 51	2 48	2 47	2 44	2 41	2 39	12
16	5 30	5 25	5 22	5 17	5 12	5 07	5 05	5 00	4 57	4 52	4 47	4 45	16
20	8 36	8 28	8 24	8 16	8 08	8 00	7 56	7 48	7 44	7 36	7 28	7 24	20
24	12 23	12 11	12 06	11 54	11 43	11 31	11 26	11 14	11 09	10 57	10 46	10 40	24
28	16 52	16 36	16 28	16 12	15 57	15 41	15 33	15 17	15 09	14 53	14 38	14 30	28
32	22 01	21 41	21 30	21 10	20 49	20 29	20 18	19 58	19 47	19 27	19 06	18 56	32
36	27 52	27 26	27 13	26 47	26 21	25 55	25 43	25 17	25 04	24 38	24 12	23 59	36
40	34 24	33 52	33 36	33 04	32 32	32 00	31 44	31 12	30 56	30 24	29 52	29 36	40
44	41 37	40 59	40 39	40 00	39 12	38 43	38 24	37 46	37 26	36 47	36 09	35 49	44
48	49 32	48 46	48 23	47 37	46 51	46 05	45 41	44 55	44 32	43 46	43 00	42 37	48
52	58 08	57 16	56 47	55 53	54 59	54 05	53 37	52 43	52 16	51 22	50 28	50 01	52
56	67 25	66 23	65 51	64 48	63 46	62 43	62 12	61 10	60 38	59 35	58 33	58 01	56
60	77 24	76 12	75 36	74 24	73 12	72 00	71 24	70 12	69 36	68 24	67 12	66 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.29	1.27	1.26	1.24	1.22	1.20	1.19	1.17	1.16	1.14	1.12	1.11	$\triangle_1 h$
Log.	0.110 59	0.103 80	0.100 37	0.093 42	0.086 36	0.079 18	0.075 55	0.068 19	0.064 46	0.056 90	0.049 22	0.045 32	Log.
Limit	65	66	67	68	69	70	71	72	73	74	75	76	Minutes
Meridian	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 17	0 17	...	...	...	...	...	...	...	...	...	4
8	1 10	1 09	1 08	...	...	...	...	...	...	...	...	...	8
12	2 38	2 36	2 33	...	...	...	...	...	...	...	...	...	12
16	4 42	4 36	4 31	...	...	...	...	...	...	...	...	...	16
20	7 20	7 12	7 04	...	...	...	...	...	...	...	...	...	20
24	10 34	10 22	10 11	...	...	...	...	...	...	...	...	...	24
28	14 22	14 07	13 51	...	...	...	...	...	...	...	...	...	28
32	18 46	18 26	18 05	...	...	...	...	...	...	...	...	...	32
36	23 46	23 20	22 54	...	...	...	...	...	...	...	...	...	36
40	29 20	28 48	28 16	...	...	...	...	...	...	...	...	...	40
44	35 30	34 51	34 12	...	...	...	...	...	...	...	...	...	44
48	42 14	41 28	40 42	...	...	...	...	...	...	...	...	...	48
52	49 34	48 40	47 46	...	...	...	...	...	...	...	...	...	52
56	57 30	56 27	55 24	...	...	...	...	...	...	...	...	...	56
60	66 00	64 48	63 36	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.10	1.08	1.06	...	...	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.041 39	0.033 42	0.025 31	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	77	78	79										Minutes
Meridian	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	Altitudes

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Latitude 47° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	0 14	0 14	0 13	0 13	0 13	0 12	0 12	0 12	0 12	0 11	4
8	0 57	0 56	0 55	0 54	0 53	0 52	0 51	0 50	0 50	0 48	0 47	0 46	8
12	2 10	2 07	2 04	2 02	1 59	1 58	1 55	1 52	1 51	1 48	1 47	1 44	12
16	3 50	3 45	3 40	3 38	3 33	3 30	3 25	3 19	3 17	3 12	3 09	3 04	16
20	6 00	5 52	5 44	5 40	5 32	5 28	5 20	5 12	5 08	5 00	4 56	4 48	20
24	8 38	8 27	8 16	8 10	7 58	7 53	7 41	7 29	7 23	7 12	7 06	6 55	24
28	11 46	11 30	11 14	11 06	10 51	10 43	10 27	10 12	10 04	9 48	9 40	9 25	28
32	15 22	15 01	14 40	14 30	14 10	13 59	13 39	13 19	13 09	12 48	12 38	12 17	32
36	19 26	19 01	18 35	18 22	17 56	17 43	17 17	16 51	16 38	16 12	15 59	15 33	36
40	24 00	23 28	22 56	22 40	22 08	21 52	21 20	20 48	20 32	20 00	19 44	19 12	40
44	29 02	28 24	27 45	27 26	26 47	26 28	25 49	25 10	24 51	24 12	23 52	23 14	44
48	34 34	33 47	33 01	32 38	31 52	31 29	30 43	29 55	29 32	28 46	28 23	27 37	48
52	40 34	39 39	38 45	38 18	37 24	36 57	36 03	35 09	34 42	33 48	33 21	32 27	52
56	47 02	46 00	44 57	44 26	43 23	42 52	41 49	40 46	40 15	39 12	38 40	37 38	56
60	54 00	52 48	51 36	51 00	49 48	49 12	48 00	46 48	46 12	45 00	44 24	43 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.90	0.88	0.86	0.85	0.83	0.82	0.80	0.78	0.77	0.75	0.74	0.72	$\triangle_1 h$
Log.	9.954 24	9.944 48	9.934 50	9.929 42	9.919 08	9.913 81	9.903 09	9.892 09	9.886 49	9.875 06	9.869 23	9.857 33	Log.
Limit	69	67	66	67	68	69	70	71	72	74	76	77	Minutes
Meridian	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	0 09	0 08	0 07	4
8	0 45	0 44	0 42	0 40	0 40	0 39	0 38	0 37	0 35	0 34	0 33	0 32	8
12	1 41	1 39	1 35	1 32	1 30	1 27	1 25	1 22	1 19	1 16	1 13	1 11	12
16	2 59	2 57	2 49	2 44	2 42	2 37	2 31	2 26	2 21	2 16	2 11	2 05	16
20	4 40	4 36	4 24	4 16	4 12	4 04	3 56	3 48	3 40	3 32	3 24	3 16	20
24	6 43	6 38	6 21	6 09	6 03	5 52	5 40	5 28	5 17	5 05	4 54	4 42	24
28	9 09	9 01	8 37	8 21	8 14	7 58	7 43	7 27	7 11	6 56	6 40	6 25	28
32	11 57	11 46	11 15	10 55	10 45	10 24	10 04	9 44	9 23	9 03	8 42	8 22	32
36	15 07	14 55	14 16	13 50	13 37	13 11	12 45	12 18	11 53	11 27	11 01	10 35	36
40	18 40	18 24	17 36	17 04	16 48	16 16	15 44	15 12	14 40	14 08	13 36	13 04	40
44	22 35	22 16	21 18	20 39	20 20	19 41	19 02	18 24	17 45	17 06	16 27	15 48	44
48	26 51	26 29	25 20	24 34	24 11	23 25	22 39	21 54	21 07	20 21	19 35	18 49	48
52	31 33	31 05	29 44	28 50	28 23	27 29	26 35	25 41	24 47	23 53	22 59	22 05	52
56	36 35	36 04	34 30	33 27	32 56	31 53	30 50	29 48	28 45	27 42	26 39	25 36	56
60	42 00	41 24	39 36	38 24	37 48	36 36	35 24	34 12	33 00	31 48	30 36	29 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.70	0.69	0.66	0.64	0.63	0.61	0.59	0.57	0.55	0.53	0.51	0.49	$\triangle_1 h$
Log.	9.845 10	9.838 85	9.819 54	9.806 18	9.799 34	9.785 33	9.770 85	9.755 87	9.740 36	9.724 28	9.707 57	9.690 20	Log.
Limit	78	78	79	79	80	81	81	82	83	83	83	84	Minutes
Meridian	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	Altitudes

Latitude 48° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 29	0 29	0 30	0 30	0 30	0 31	0 31	0 32	0 33	0 34	0 35	4
8	1 54	1 55	1 57	1 59	2 01	2 02	2 04	2 07	2 09	2 12	2 14	2 17	8
12	4 16	4 19	4 23	4 28	4 32	4 37	4 41	4 47	4 51	4 57	5 02	5 08	12
16	7 33	7 41	7 49	7 56	8 04	8 11	8 19	8 29	8 37	8 47	8 58	9 08	16
20	11 48	12 00	12 12	12 24	12 36	12 48	13 00	13 16	13 28	13 44	14 00	14 16	20
24	16 59	17 17	17 34	17 52	18 09	18 26	18 43	19 06	19 24	19 47	20 10	20 33	24
28	23 08	23 31	23 55	24 18	24 42	25 06	25 29	26 01	26 24	26 55	27 26	27 57	28
32	30 13	30 43	31 13	31 44	32 15	32 46	33 17	33 58	34 28	35 09	35 50	36 31	32
36	38 14	38 53	39 32	40 11	40 50	41 28	42 07	42 59	43 38	44 30	45 22	46 14	36
40	47 12	48 00	48 48	49 36	50 24	51 12	52 00	53 04	53 52	54 56	56 00	57 04	40
44	57 07	58 05	59 03	60 01	60 59	61 57	62 55	64 12	65 11	66 28	67 46	69 03	44
48	67 56	69 07	70 16	71 25	72 34	73 44	74 53	76 25	77 34	79 06	80 38	82 10	48
52	79 46	81 07	82 28	83 49	85 10	86 32	87 53	89 41	91 02	92 50	94 38	96 26	52
56	92 31	94 05	95 39	97 13	98 47	100 21	101 55	104 00	105 35	...	...	...	56
60	106 12	108 00	109 48	111 36	113 24	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.77	1.80	1.83	1.86	1.89	1.92	1.95	1.99	2.02	2.06	2.10	2.14	$\triangle_1 h$
Log.	0.247 97	0.255 27	0.262 45	0.269 51	0.276 46	0.283 30	0.290 03	0.298 85	0.305 35	0.313 87	0.322 22	0.330 41	Log.
Limit	49	49	48	48	47	47	46	46	45	45	44	44	Minutes
Meridian	42°	43°	44°	45°	46°	47°	48°	49°	50°	51°	52°	53°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 35	0 36	0 37	0 38	0 39	0 40	0 41	0 42	0 43	0 44	0 46	4
8	2 20	2 23	2 26	2 29	2 32	2 37	2 40	2 44	2 48	2 53	2 58	3 03	8
12	5 15	5 21	5 29	5 35	5 43	5 52	6 00	6 09	6 18	6 29	6 41	6 52	12
16	9 21	9 31	9 43	9 57	10 09	10 24	10 40	10 55	11 14	11 31	11 51	12 12	16
20	14 36	14 52	15 12	15 32	15 52	16 16	16 40	17 04	17 32	18 00	18 32	19 04	20
24	21 02	21 24	21 53	22 22	22 51	23 25	24 00	24 35	25 15	25 55	26 41	27 28	24
28	28 37	29 09	29 48	30 27	31 06	31 53	32 40	33 27	34 22	35 17	36 20	37 22	28
32	37 22	38 04	38 55	39 46	40 37	41 39	42 40	43 41	44 53	46 05	47 27	48 48	32
36	47 19	48 10	49 15	50 20	51 25	52 42	54 00	55 18	56 49	58 19	60 03	61 47	36
40	58 24	59 28	60 48	62 08	63 28	65 04	66 40	68 16	70 08	72 00	74 08	76 16	40
44	70 40	71 57	73 34	75 11	76 48	78 43	80 40	82 36	84 52	87 07	...	...	44
48	84 05	85 38	87 33	89 28	91 23	93 42	96 00	...	...	...	...	...	48
52	98 41	100 30	102 45	105 00	107 15	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.19	2.23	2.28	2.33	2.38	2.44	2.50	2.56	2.63	2.70	2.78	2.86	$\triangle_1 h$
Log.	0.340 44	0.348 30	0.357 93	0.367 36	0.376 58	0.387 39	0.397 94	0.408 24	0.419 96	0.431 36	0.444 04	0.456 37	Log.
Limit	43	43	42	41	41	40	39	38	37	36	35	34	Minutes
Meridian	54°	55°	56°	57°	58°	59°	60°	61°	62°	63°	64°	65°	Altitudes

Latitude 48° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 47	0 49	0 51	0 52	0 54	0 56	0 59	1 02	1 05	1 07	1 12	1 17	4
8	3 08	3 15	3 21	3 30	3 38	3 46	3 55	4 06	4 19	4 33	4 48	5 06	8
12	7 05	7 19	7 33	7 51	8 08	8 28	8 50	9 14	9 42	10 14	10 48	11 29	12
16	12 35	13 01	13 27	13 57	14 28	15 04	15 42	16 26	17 14	18 10	19 12	20 23	16
20	19 40	20 20	21 00	21 48	22 36	23 32	24 32	25 40	26 56	28 24	30 00	31 52	20
24	28 19	29 17	30 15	31 23	32 32	33 53	35 20	36 58	38 47	40 54	43 12	45 53	24
28	38 33	39 51	41 09	42 44	44 18	46 08	48 05	50 18	52 47	55 40	58 48	62 26	28
32	50 21	52 03	53 45	55 49	57 51	60 15	62 48	65 42	68 57	...	...	...	32
36	63 43	65 53	68 03	70 38	73 14	76 15	...	...	...	...	...	...	36
40	78 40	81 20	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.95	3.05	3.15	3.27	3.39	3.53	3.68	3.85	4.04	4.26	4.50	4.78	$\triangle_1 h$
Log.	0.469 82	0.484 30	0.498 31	0.514 55	0.530 20	0.547 77	0.565 85	0.585 46	0.606 38	0.629 41	0.653 21	0.679 43	Log.
Limit	33	33	32	31	30	29	28	27	26	25	24	23	Minutes
Meridian	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 22	1 28	1 35	1 44	1 55	2 10	2 29	2 56	...	...	...	...	4
8	5 26	5 52	6 21	6 57	7 43	8 41	9 58	11 45	...	...	...	...	8
12	12 15	13 12	14 19	15 39	17 21	19 32	22 25	26 27	...	...	...	...	12
16	21 49	23 28	25 25	27 49	30 51	34 44	39 51	...	...	...	...	...	16
20	34 04	36 40	39 44	43 28	48 12	54 16	...	...	...	...	...	...	20
24	49 04	52 48	57 13	62 36	...	...	...	...	...	...	...	...	24
28	66 46	71 52	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.11	5.50	5.96	6.52	7.23	8.14	9.34	11.02	...	...	...	...	$\triangle_1 h$
Log.	0.708 42	0.740 36	0.775 25	0.814 25	0.859 14	0.910 62	0.970 35	1.042 18	... ...	... ...	... ...	... ...	Log.
Limit	23	22	21	19	17	16	14	12	10	8	5	3	Minutes
Meridian	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	Altitudes

Latitude 48° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	2 25	1 58	1 39	1 24	1 13	1 04	0 57	4
8	...	...	...	...	...	9 41	7 53	6 35	5 38	4 53	4 17	3 47	8
12	...	...	...	...	...	21 46	17 44	14 50	12 41	10 58	9 37	8 31	12
16	...	...	...	...	...	38 42	31 32	26 22	22 31	19 30	17 07	15 09	16
20	...	...	...	...	...	...	49 16	41 12	35 12	30 28	26 44	23 40	20
24	...	...	...	...	...	...	...	...	50 41	43 52	38 30	34 05	24
28	...	...	...	...	...	...	...	...	...	...	52 24	46 23	28
32	...	...	...	...	...	...	...	...	...	...	...	60 35	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	9.07	7.39	6.18	5.28	4.57	4.01	3.55	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	0.957 61	0.868 64	0.790 99	0.722 63	0.659 92	0.603 14	0.550 23	Log.
Limit	0	3	5	8	11	13	15	17	19	21	23	25	Minutes
Meridian	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 51	0 46	0 41	0 37	0 34	0 30	0 27	0 26	0 23	0 21	0 19	0 17	4
8	3 21	3 01	2 43	2 27	2 14	2 01	1 51	1 42	1 33	1 23	1 17	1 10	8
12	7 35	6 47	6 07	5 31	5 01	4 34	4 09	3 48	3 28	3 08	2 53	2 37	12
16	13 29	12 05	10 53	9 49	8 36	8 06	7 23	6 44	6 08	5 36	5 07	4 39	16
20	21 04	18 52	17 00	15 20	13 56	12 40	11 32	10 32	9 36	8 44	8 00	7 16	20
24	30 21	27 10	24 29	22 05	20 04	18 14	16 36	15 10	13 49	12 35	11 31	10 28	24
28	41 17	36 59	33 19	30 03	27 19	24 50	22 37	20 39	18 49	17 07	15 41	14 15	28
32	53 55	48 18	43 31	39 15	35 40	32 26	29 32	26 58	24 35	22 21	20 29	18 36	32
36	...	61 08	55 05	49 41	45 09	41 02	37 22	34 08	31 06	28 18	25 55	23 33	36
40	...	...	...	61 20	55 44	50 40	46 08	42 08	38 24	34 56	32 00	29 04	40
44	...	...	...	...	...	61 18	55 49	50 59	46 27	42 16	38 43	35 10	44
48	...	...	...	...	...	...	66 24	60 40	55 18	50 18	46 05	41 51	48
52	...	...	...	...	...	...	...	71 12	64 54	59 02	54 05	49 07	52
56	...	...	...	...	...	...	...	...	...	68 28	62 43	56 58	56
60	...	...	...	...	...	...	...	...	...	...	72 00	65 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.16	2.83	2.55	2.30	2.09	1.90	1.73	1.58	1.44	1.31	1.20	1.09	$\triangle_1 h$
Log.	0.499 69	0.451 79	0.406 54	0.361 73	0.320 15	0.278 75	0.238 05	0.198 66	0.158 36	0.117 27	0.079 18	0.037 43	Log.
Limit	27	29	31	33	35	37	39	41	43	45	48	51	Minutes
Meridian	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	67°	Altitudes

Latitude 48° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 28	0 27	0 27	0 27	0 27	0 26	0 25	0 25	0 25	0 24	0 24	4
8	1 54	1 52	1 50	1 48	1 46	1 45	1 43	1 42	1 41	1 39	1 38	1 36	8
12	4 16	4 11	4 06	4 03	3 59	3 56	3 53	3 49	3 46	3 43	3 40	3 36	12
16	7 33	7 25	7 18	7 13	7 05	7 00	6 55	6 47	6 42	6 37	6 32	6 24	16
20	11 48	11 36	11 24	11 16	11 04	10 56	10 48	10 36	10 28	10 20	10 12	10 00	20
24	16 59	16 42	16 25	16 14	15 57	15 45	15 34	15 16	15 04	14 53	14 41	14 24	24
28	23 08	22 44	22 21	22 05	21 41	21 25	21 10	20 47	20 31	20 15	20 00	19 36	28
32	30 13	29 42	29 11	28 50	28 19	27 59	27 38	27 08	26 48	26 27	26 07	25 36	32
36	38 14	37 35	36 56	36 31	35 52	35 26	35 00	34 21	33 55	33 29	33 03	32 24	36
40	47 12	46 24	45 36	45 04	44 16	43 44	43 12	42 24	41 52	41 20	40 48	40 00	40
44	57 07	56 08	55 10	54 32	53 34	52 55	52 17	51 18	50 40	50 01	49 22	48 24	44
48	67 56	66 47	65 38	64 53	63 44	62 58	62 12	61 03	60 17	59 31	58 45	57 36	48
52	79 46	78 25	77 04	76 09	74 48	73 54	73 00	71 39	70 45	69 51	68 57	67 36	52
56	92 31	90 56	89 22	88 20	86 46	85 43	84 41	83 06	82 04	81 01	79 58	78 24	56
60	106 12	104 24	102 36	101 24	99 36	98 24	97 12	95 24	94 12	93 00	91 48	90 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.77	1.74	1.71	1.69	1.66	1.64	1.62	1.59	1.57	1.55	1.53	1.50	△₁h
Log.	0.247 97	0.240 55	0.233 00	0.227 89	0.220 11	0.214 84	0.209 52	0.201 40	0.195 90	0.190 33	0.184 69	0.176 09	Log.
Limit	49	49	50	51	52	53	53	54	55	56	56	56	Minutes
Meridian	42°	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 23	0 22	0 22	0 22	0 22	0 22	0 22	0 21	0 21	0 21	0 20	4
8	1 35	1 34	1 33	1 31	1 30	1 29	1 28	1 26	1 25	1 23	1 23	1 22	8
12	3 34	3 31	3 28	3 25	3 23	3 20	3 17	3 14	3 11	3 08	3 07	3 05	12
16	6 18	6 13	6 08	6 03	6 01	5 56	5 51	5 46	5 41	5 36	5 33	5 27	16
20	9 52	9 44	9 36	9 28	9 24	9 16	9 08	9 00	8 52	8 44	8 40	8 32	20
24	14 12	14 01	13 49	13 38	13 32	13 21	13 09	12 58	12 46	12 35	12 29	12 17	24
28	19 21	19 05	18 49	18 34	18 26	18 10	17 54	17 38	17 23	17 07	16 59	16 44	28
32	25 16	24 55	24 35	24 14	24 04	23 43	23 23	23 02	22 42	22 21	22 11	21 51	32
36	31 58	31 32	31 06	30 40	30 27	30 02	29 36	29 10	28 44	28 18	28 05	27 39	36
40	39 28	38 56	38 24	37 52	37 36	37 04	36 32	36 00	35 28	34 56	34 40	34 08	40
44	47 45	47 06	46 27	45 49	45 29	44 51	44 13	43 34	42 55	42 16	41 57	41 18	44
48	56 50	56 04	55 18	54 32	54 09	53 22	52 36	51 50	51 04	50 18	49 55	49 09	48
52	66 42	65 48	64 54	64 00	63 33	62 38	61 44	60 50	59 56	59 02	58 35	57 41	52
56	77 21	76 18	75 15	74 13	73 41	72 39	71 37	70 34	69 31	68 28	67 57	66 54	56
60	88 48	87 36	86 24	85 12	84 36	83 24	82 12	81 00	79 48	78 36	78 00	76 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	1.48	1.46	1.44	1.42	1.41	1.39	1.37	1.35	1.33	1.31	1.30	1.28	△₁h
Log.	0.170 26	0.164 35	0.158 36	0.152 29	0.149 22	0.143 01	0.136 72	0.130 33	0.123 85	0.117 27	0.113 94	0.107 21	Log.
Limit	57	58	59	60	60	61	61	62	63	63	64	65	Minutes
Meridian	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	Altitudes

Latitude 48° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 20	0 20	0 19	0 19	0 19	0 19	0 19	0 19	0 18	0 18	0 17	4
8	1 21	1 20	1 19	1 18	1 17	1 15	1 14	1 13	1 12	1 11	1 10	1 09	8
12	3 02	2 59	2 57	2 54	2 53	2 50	2 47	2 44	2 42	2 41	2 38	2 35	12
16	5 22	5 17	5 15	5 10	5 07	5 02	4 57	4 52	4 50	4 47	4 42	4 36	16
20	8 24	8 16	8 12	8 04	8 00	7 52	7 44	7 36	7 32	7 28	7 20	7 12	20
24	12 06	11 54	11 48	11 37	11 31	11 20	11 09	10 57	10 51	10 46	10 34	10 22	24
28	16 28	16 12	16 05	15 49	15 41	15 25	15 09	14 53	14 46	14 38	14 22	14 07	28
32	21 30	21 10	21 00	20 39	20 29	20 08	19 47	19 27	19 17	19 06	18 46	18 26	32
36	27 13	26 47	26 34	26 08	25 55	25 30	25 04	24 38	24 25	24 12	23 46	23 20	36
40	33 36	33 04	32 48	32 16	32 00	31 28	30 56	30 24	30 08	29 52	29 20	28 48	40
44	40 38	40 00	39 41	39 02	38 43	38 05	37 26	36 47	36 28	36 09	35 30	34 51	44
48	48 23	47 37	47 14	46 28	46 05	45 18	44 32	43 46	43 23	43 00	42 14	41 28	48
52	56 47	55 53	55 26	54 32	54 05	53 10	52 16	51 22	50 55	50 28	49 34	48 40	52
56	65 51	64 48	64 17	63 14	62 43	61 41	60 38	59 35	59 04	58 33	57 30	56 27	56
60	75 36	74 24	73 48	72 36	72 00	70 48	69 36	68 24	67 48	67 12	66 50	64 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.26	1.24	1.23	1.21	1.20	1.18	1.16	1.14	1.13	1.12	1.10	1.08	$\Delta_1 h$
Log.	0.100 37	0.093 42	0.089 91	0.082 79	0.079 18	0.071 88	0.064 46	0.056 90	0.053 08	0.049 22	0.041 39	0.033 42	Log.
Limit	66	67	67	68	69	70	71	73	74	75	76	77	Minutes
Meridian	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	...	...	...	...	...	...	...	...	...	0 14	4
8	1 09	1 07	...	...	...	...	...	...	...	...	...	0 57	8
12	2 34	2 31	...	...	...	...	...	...	...	...	...	2 10	12
16	4 34	4 29	...	...	...	...	...	...	...	...	...	3 50	16
20	7 08	7 00	...	...	...	...	...	...	...	...	...	6 00	20
24	10 16	10 05	...	...	...	...	...	...	...	...	...	8 38	24
28	13 59	13 43	...	...	...	...	...	...	...	...	...	11 46	28
32	18 16	17 55	...	...	...	...	...	...	...	...	...	15 22	32
36	23 07	22 41	...	...	...	...	...	...	...	...	...	19 26	36
40	28 32	28 00	...	...	...	...	...	...	...	...	...	24 00	40
44	34 32	33 53	...	...	...	...	...	...	...	...	...	29 02	44
48	41 05	40 19	...	...	...	...	...	...	...	...	...	34 34	48
52	48 13	47 19	...	...	...	...	...	...	...	...	...	40 34	52
56	55 56	54 50	...	...	...	...	...	...	...	...	...	47 02	56
60	64 12	63 00	...	...	...	...	...	...	...	...	...	54 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.07	1.05	...	...	...	...	...	...	...	...	...	0.90	$\Delta_1 h$
Log.	0.029 38	0.021 19	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.954 24	Log.
Limit	78	79										69	Minutes
Meridian	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	Altitudes

Latitude 48° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	0 14	0 14	0 13	0 13	0 12	0 12	0 12	0 12	0 12	0 11	4
8	0 56	0 56	0 54	0 54	0 52	0 52	0 51	0 50	0 48	0 48	0 47	0 46	8
12	2 07	2 05	2 02	2 01	1 58	1 56	1 54	1 51	1 48	1 47	1 45	1 42	12
16	3 45	3 43	3 38	3 35	3 30	3 28	3 22	3 17	3 12	3 09	3 07	3 02	16
20	5 52	5 48	5 40	5 36	5 28	5 24	5 16	5 08	5 00	4 56	4 52	4 44	20
24	8 27	8 21	8 10	8 04	7 53	7 47	7 35	7 23	7 12	7 06	7 00	6 49	24
28	11 30	11 22	11 06	10 58	10 43	10 35	10 20	10 04	9 48	9 40	9 33	9 17	28
32	15 01	14 51	14 30	14 20	13 59	13 49	13 29	13 09	12 48	12 38	12 28	12 07	32
36	19 01	18 48	18 22	18 09	17 43	17 30	17 04	16 38	16 12	15 59	15 46	15 20	36
40	23 28	23 12	22 40	22 24	21 52	21 36	21 04	20 32	20 00	19 44	19 28	18 56	40
44	28 24	28 05	27 26	27 06	26 28	26 08	25 29	24 51	24 12	23 52	23 33	22 54	44
48	33 47	33 24	32 38	32 15	31 29	31 06	30 18	29 32	28 46	28 23	28 00	27 14	48
52	39 39	39 12	38 18	37 51	36 57	36 30	35 36	34 42	33 48	33 21	32 54	32 00	52
56	46 00	45 29	44 26	43 54	42 52	42 20	41 17	40 15	39 12	38 40	38 09	37 07	56
60	52 48	52 12	51 00	50 24	49 12	48 36	47 24	46 12	45 00	44 24	43 48	42 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.88	0.87	0.85	0.84	0.82	0.81	0.79	0.77	0.75	0.74	0.73	0.71	$\triangle_1 h$
Log.	9.944 48	9.939 52	9.929 42	9.924 28	9.913 81	9.908 49	9.897 63	9.886 49	9.875 06	9.869 23	9.863 32	9.851 26	Log.
Limit	68	67	66	67	68	68	69	70	71	73	75	76	Minutes
Meridian	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	0 09	0 08	0 07	4
8	0 45	0 43	0 41	0 40	0 39	0 38	0 37	0 37	0 35	0 34	0 33	0 32	8
12	1 41	1 38	1 33	1 30	1 29	1 26	1 24	1 22	1 19	1 16	1 13	1 11	12
16	2 59	2 54	2 47	2 42	2 39	2 34	2 28	2 26	2 21	2 16	2 11	2 05	16
20	4 40	4 32	4 20	4 12	4 08	4 00	3 52	3 48	3 40	3 32	3 24	3 16	20
24	6 43	6 32	6 15	6 03	5 58	5 46	5 34	5 28	5 17	5 05	4 54	4 42	24
28	9 09	8 53	8 29	8 14	8 06	7 50	7 35	7 27	7 11	6 56	6 40	6 25	28
32	11 57	11 36	11 05	10 45	10 34	10 14	9 54	9 44	9 23	9 03	8 42	8 22	32
36	15 07	14 42	14 03	13 37	13 24	12 58	12 32	12 19	11 53	11 27	11 01	10 35	36
40	18 40	18 08	17 20	16 48	16 32	16 00	15 28	15 12	14 40	14 08	13 36	13 04	40
44	22 35	21 57	20 59	20 20	20 01	19 22	18 43	18 24	17 45	17 06	16 27	15 48	44
48	26 51	26 08	24 57	24 11	23 48	23 02	22 16	21 52	21 07	20 21	19 35	18 49	48
52	31 33	30 38	29 17	28 23	27 56	27 02	26 08	25 41	24 47	23 53	22 59	22 05	52
56	36 35	35 33	33 59	32 56	32 25	31 22	30 19	29 48	28 45	27 42	26 39	25 36	56
60	42 00	40 48	39 00	37 48	37 12	36 00	34 48	34 12	33 00	31 48	30 36	29 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.70	0.68	0.65	0.63	0.62	0.60	0.58	0.57	0.55	0.53	0.51	0.49	$\triangle_1 h$
Log.	9.845 10	9.832 51	9.812 91	9.799 34	9.792 39	9.778 15	9.763 43	9.755 87	9.740 36	9.724 28	9.707 57	9.690 20	Log.
Limit	76	77	78	79	79	80	80	81	82	83	83	24	Minutes
Meridian	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	Altitudes

Latitude 49° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 28	0 28	0 29	0 30	0 30	0 30	0 31	0 31	0 32	0 33	4
8	1 50	1 51	1 53	1 55	1 56	1 58	2 00	2 02	2 04	2 06	2 09	2 11	8
12	4 06	4 09	4 14	4 18	4 22	4 26	4 31	4 35	4 40	4 46	4 51	4 55	12
16	7 18	7 23	7 30	7 38	7 46	7 54	8 01	8 09	8 16	8 26	8 37	8 45	16
20	11 24	11 32	11 44	11 56	12 08	12 20	12 32	12 44	12 56	13 12	13 28	13 40	20
24	16 25	16 36	16 54	17 11	17 29	17 46	18 03	18 20	18 37	19 00	19 24	19 41	24
28	22 21	22 37	23 00	23 24	23 47	24 10	24 34	24 58	25 21	25 53	26 24	26 47	28
32	29 11	29 32	30 02	30 33	31 03	31 34	32 05	32 36	33 07	33 48	34 28	34 59	32
36	36 56	37 22	38 01	38 40	39 19	39 58	40 37	41 15	41 54	42 46	43 38	44 17	36
40	45 36	46 08	46 56	47 44	48 32	49 20	50 08	50 56	51 44	52 48	53 52	54 40	40
44	55 10	55 49	56 47	57 45	58 44	59 42	60 40	61 37	62 35	63 53	65 11	66 09	44
48	65 38	66 24	67 33	68 42	69 53	71 02	72 11	73 21	74 30	76 02	77 34	78 43	48
52	77 04	77 58	79 19	80 40	82 01	83 22	84 43	86 05	87 26	89 14	91 02	92 23	52
56	89 22	90 25	91 59	93 33	95 08	96 42	98 15	99 49	101 23	103 29	105 35	107 08	56
60	102 36	103 48	105 36	107 24	109 12	111 00	112 48	114 36	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.71	1.73	1.76	1.79	1.82	1.85	1.88	1.91	1.94	1.98	2.02	2.05	$\triangle_1 h$
Log.	0.233 00	0.238 05	0.245 51	0.252 85	0.260 07	0.267 17	0.274 16	0.281 03	0.287 80	0.296 67	0.305 35	0.311 75	Log.
Limit	50	50	49	49	48	48	47	47	46	46	45	45	Minutes
Meridian	41°	42°	43°	44°	45°	46°	47°	48°	49°	50°	51°	52°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 33	0 34	0 35	0 35	0 36	0 37	0 38	0 39	0 40	0 41	0 42	0 43	4
8	2 14	2 16	2 19	2 23	2 26	2 28	2 32	2 37	2 40	2 44	2 48	2 53	8
12	5 01	5 06	5 14	5 21	5 27	5 34	5 43	5 52	6 00	6 09	6 18	6 29	12
16	8 55	9 06	9 18	9 31	9 41	9 54	10 09	10 24	10 40	10 55	11 14	11 31	16
20	13 56	14 12	14 32	14 52	15 08	15 28	15 52	16 16	16 40	17 04	17 32	18 00	20
24	20 04	20 27	20 56	21 24	21 47	22 17	22 51	23 25	24 00	24 35	25 15	25 55	24
28	27 19	27 50	28 29	29 09	29 40	30 19	31 06	31 53	32 40	33 27	34 22	35 17	28
32	35 40	36 21	37 12	38 04	38 45	39 35	40 37	41 39	42 40	43 41	44 53	46 05	32
36	45 09	46 01	47 06	48 10	49 02	50 07	51 25	52 42	54 00	55 18	56 49	58 19	36
40	55 44	56 48	58 08	59 28	60 32	61 52	63 28	65 04	66 40	68 16	70 08	72 00	40
44	67 26	68 44	70 21	71 57	73 15	74 52	76 48	78 43	80 40	82 36	84 52	87 07	44
48	80 15	81 46	83 42	85 38	87 10	89 05	91 23	93 42	96 00	...	...	...	48
52	94 11	95 59	98 14	100 30	102 18	104 33	107 15	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.09	2.13	2.18	2.23	2.27	2.32	2.38	2.44	2.50	2.56	2.63	2.70	$\triangle_1 h$
Log.	0.320 15	0.328 38	0.338 46	0.348 30	0.356 03	0.365 49	0.376 58	0.387 39	0.397 94	0.408 24	0.419 96	0.431 36	Log.
Limit	44	44	43	42	42	41	41	40	39	38	37	36	Minutes
Meridian	53°	54°	55°	56°	57°	58°	59°	60°	61°	62°	63°	64°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 44	0 46	0 47	0 49	0 50	0 52	0 54	0 57	1 00	1 02	1 06	1 10	4
8	2 58	3 04	3 10	3 16	3 23	3 31	3 40	3 49	4 00	4 10	4 23	4 39	8
12	6 41	6 55	7 08	7 21	7 36	7 54	8 14	8 34	8 59	9 25	9 53	10 28	12
16	11 51	12 17	12 40	13 03	13 32	14 02	14 38	15 14	15 57	16 43	17 35	18 36	16
20	18 32	19 12	19 48	20 24	21 08	21 56	22 52	23 48	24 56	26 08	27 28	29 04	20
24	26 41	27 39	28 30	29 23	30 26	31 35	32 55	34 16	35 54	37 38	39 34	41 52	24
28	36 20	37 38	38 49	39 59	41 25	43 00	44 50	46 39	48 52	51 14	53 50	56 58	28
32	47 27	49 09	50 42	52 13	54 06	56 09	58 33	60 56	63 50	66 54	...	...	32
36	60 03	62 13	64 09	66 06	68 29	71 04	74 05	...	...	...	...	...	36
40	74 08	76 48	79 12	81 36	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.78	2.88	2.97	3.06	3.17	3.29	3.43	3.57	3.74	3.92	4.12	4.36	$\triangle_1 h$
Log.	0.444 04	0.459 39	0.472 76	0.485 72	0.501 06	0.517 20	0.535 29	0.552 67	0.572 87	0.593 29	0.614 90	0.639 49	Log.
Limit	35	34	33	32	31	30	29	28	27	26	25	25	Minutes
Meridian	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 14	1 19	1 25	1 32	1 41	1 51	2 06	2 24	2 50	...	...	...	4
8	4 56	5 16	5 40	6 09	6 44	7 26	8 22	9 37	11 20	...	...	...	8
12	11 06	11 53	12 44	13 50	15 08	16 46	18 50	21 37	25 30	...	...	...	12
16	19 46	21 07	22 40	24 34	26 56	29 46	33 30	38 27	45 22	...	...	...	16
20	30 52	33 00	35 24	38 24	42 04	46 32	52 20	...	...	...	...	...	20
24	44 27	47 31	50 59	55 18	60 35	...	...	...	...	...	...	...	24
28	60 30	64 41	69 23	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.63	4.95	5.31	5.76	6.31	6.98	7.85	9.01	10.63	...	...	...	$\triangle_1 h$
Log.	0.665 58	0.694 61	0.725 09	0.760 42	0.800 03	0.843 86	0.894 87	0.954 72	1.026 53	... ...	... ...	... ...	Log.
Limit	24	23	22	21	19	18	16	14	12	10	8	6	Minutes
Meridian	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	Altitudes

Latitude 49° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	2 19	1 53	1 34	1 21	1 10	1 01	4
8	...	...	...	...	...	...	9 16	7 33	6 18	5 23	4 39	4 05	8
12	...	...	...	...	...	...	20 51	16 58	14 11	12 06	10 28	9 10	12
16	...	...	...	...	...	...	37 05	30 10	25 13	21 30	18 36	16 18	16
20	...	...	...	...	...	...	...	...	39 24	33 36	29 04	25 18	20
24	...	...	...	...	...	...	...	...	...	48 23	41 52	36 41	24
28	...	...	...	...	...	...	...	...	...	...	...	49 55	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	8.69	7.07	5.91	5.04	4.36	3.82	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	0.939 02	0.849 42	0.771 59	0.702 43	0.639 49	0.582 06	Log.
Limit	3	0	3	5	7	9	12	14	17	19	21	23	Minutes
Meridian	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	″ ′	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 54	0 48	0 43	0 38	0 35	0 32	0 28	0 26	0 23	0 22	0 19	0 18	4
8	3 36	3 12	2 52	2 35	2 19	2 05	1 55	1 44	1 35	1 26	1 19	1 11	8
12	8 07	7 12	6 27	5 49	5 14	4 44	4 18	3 54	3 34	3 14	2 57	2 39	12
16	14 25	12 48	11 29	10 19	9 18	8 24	7 38	6 58	6 18	5 46	5 15	4 45	16
20	22 27	20 00	17 56	16 08	14 32	13 08	11 56	10 52	9 52	9 00	8 12	7 24	20
24	32 27	28 48	25 50	23 14	20 56	18 44	17 11	15 39	14 12	12 58	11 48	10 40	24
28	44 10	39 12	35 09	31 38	28 29	25 45	22 24	21 18	19 21	17 38	16 05	14 30	28
32	57 41	51 12	45 54	41 18	37 12	33 48	30 33	27 49	25 16	23 02	21 00	18 56	32
36	...	...	58 07	52 16	47 06	42 33	38 40	35 13	31 58	29 10	26 34	23 59	36
40	...	...	...	...	58 08	52 32	47 44	43 28	39 28	36 00	32 48	29 36	40
44	...	...	...	...	...	63 34	57 45	52 36	47 45	43 34	39 41	35 49	44
48	...	...	...	...	...	...	...	62 35	56 50	51 50	47 14	42 37	48
52	...	...	...	...	...	...	...	...	...	60 50	55 26	50 01	52
56	...	...	...	...	...	...	...	...	...	...	64 17	58 01	56
60	...	...	...	...	...	...	...	...	...	...	...	66 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.38	3.00	2.69	2.42	2.18	1.97	1.79	1.63	1.48	1.35	1.23	1.11	$\triangle_1 h$
Log.	0.528 92	0.477 12	0.429 75	0.383 82	0.338 46	0.294 47	0.252 85	0.212 19	0.170 26	0.130 33	0.089 91	0.045 32	Log.
Limit	26	28	30	32	34	36	38	40	42	45	47	48	Minutes
Meridian	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	68°	Altitudes

Latitude 49° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 27	0 26	0 26	0 25	0 25	0 25	0 24	0 24	0 23	0 23	4
8	1 50	1 47	1 46	1 44	1 42	1 42	1 40	1 39	1 37	1 36	1 35	1 34	8
12	4 06	4 02	3 59	3 54	3 51	3 49	3 45	3 42	3 39	3 36	3 34	3 31	12
16	7 18	7 10	7 05	6 58	6 53	6 47	6 39	6 34	6 29	6 24	6 18	6 13	16
20	11 24	11 12	11 04	10 52	10 44	10 36	10 24	10 16	10 08	10 00	9 52	9 44	20
24	16 25	16 08	15 57	15 39	15 28	15 16	14 59	14 47	14 36	14 24	14 12	14 01	24
28	22 21	21 57	21 41	21 18	21 02	20 47	20 23	20 07	19 52	19 36	19 21	19 05	28
32	29 11	28 40	28 19	27 49	27 28	27 08	26 37	26 17	25 56	25 36	25 16	24 55	32
36	36 56	36 18	35 52	35 13	34 47	34 21	33 42	33 16	32 50	32 24	31 58	31 32	36
40	45 36	44 48	44 16	43 28	42 56	42 24	41 36	41 04	40 32	40 00	39 28	38 56	40
44	55 10	54 13	53 34	52 36	51 57	51 18	50 20	49 41	49 03	48 24	47 45	47 06	44
48	65 38	64 30	63 44	62 35	61 49	61 03	59 54	59 08	58 22	57 36	56 50	56 04	48
52	77 04	75 42	74 48	73 27	72 33	71 39	70 18	69 24	68 30	67 36	66 42	65 48	52
56	89 22	87 49	86 46	85 12	84 09	83 06	81 32	80 29	79 27	78 24	77 21	76 18	56
60	102 36	100 48	99 36	97 48	96 36	95 24	93 36	92 24	91 12	90 00	88 48	87 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.71	1.68	1.66	1.63	1.61	1.59	1.56	1.54	1.52	1.50	1.48	1.46	$\Delta_1 h$
Log.	0.233 00	0.225 31	0.220 11	0.212 19	0.206 83	0.201 40	0.193 12	0.187 52	0.181 84	0.176 09	0.170 26	0.164 35	Log.
Limit	50	50	51	52	53	54	54	54	55	56	57	57	Minutes
Meridian	41°	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 22	0 22	0 22	0 21	0 21	0 21	0 20	0 20	0 20	4
8	1 33	1 31	1 30	1 28	1 28	1 26	1 25	1 23	1 23	1 22	1 21	1 20	8
12	3 28	3 25	3 22	3 19	3 17	3 14	3 11	3 08	3 07	3 05	3 02	3 00	12
16	6 08	6 03	5 58	5 53	5 51	5 46	5 41	5 36	5 33	5 27	5 22	5 20	16
20	9 36	9 28	9 20	9 12	9 08	9 00	8 52	8 44	8 40	8 32	8 24	8 20	20
24	13 49	13 38	13 26	13 15	13 09	12 58	12 46	12 35	12 29	12 17	12 06	12 00	24
28	18 49	18 34	18 18	18 02	17 54	17 38	17 23	17 07	16 59	16 44	16 28	16 20	28
32	24 35	24 14	23 54	23 33	23 23	23 02	22 42	22 21	22 11	21 51	21 30	21 20	32
36	31 06	30 40	30 14	29 49	29 36	29 10	28 44	28 18	28 05	27 39	27 13	27 00	36
40	38 24	37 52	37 20	36 48	36 32	36 00	35 28	34 56	34 40	34 08	33 36	33 20	40
44	46 27	45 49	45 10	44 32	44 13	43 34	42 55	42 16	41 57	41 18	40 39	40 20	44
48	55 18	54 32	53 46	52 59	52 36	51 50	51 04	50 18	49 55	49 09	48 23	48 00	48
52	64 54	64 00	63 06	62 11	61 44	60 50	59 56	59 02	58 35	57 41	56 47	56 20	52
56	75 15	74 13	73 10	72 08	71 37	70 34	69 31	68 28	67 57	66 54	65 51	65 20	56
60	86 24	85 12	84 00	82 48	82 12	81 00	79 48	78 36	78 00	76 48	75 36	75 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.44	1.42	1.40	1.38	1.37	1.35	1.33	1.31	1.30	1.28	1.26	1.25	$\Delta_1 h$
Log.	0.158 36	0.152 29	0.146 13	0.139 88	0.136 72	0.130 33	0.123 85	0.117 27	0.113 94	0.107 21	0.100 37	0.096 91	Log.
Limit	58	59	60	61	61	61	62	63	64	64	65	66	Minutes
Meridian	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	Altitudes

Latitude 49° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 19	0 19	0 19	0 19	0 19	0 18	0 18	0 18	0 17	0 17	0 17	4
8	1 19	1 17	1 17	1 15	1 15	1 13	1 12	1 11	1 11	1 10	1 09	1 08	8
12	2 57	2 54	2 53	2 50	2 48	2 45	2 42	2 41	2 39	2 37	2 36	2 33	12
16	5 15	5 10	5 07	5 02	5 00	4 55	4 50	4 47	4 45	4 39	4 36	4 31	16
20	8 12	8 04	8 00	7 52	7 48	7 40	7 32	7 28	7 24	7 16	7 12	7 04	20
24	11 48	11 37	11 31	11 20	11 14	11 03	10 51	10 46	10 40	10 28	10 22	10 11	24
28	16 05	15 49	15 41	15 25	15 17	15 01	14 46	14 38	14 30	14 15	14 07	13 51	28
32	21 00	20 39	20 29	20 08	19 58	19 37	19 17	19 06	18 56	18 36	18 26	18 05	32
36	26 34	26 08	25 55	25 30	25 17	24 51	24 25	24 12	23 59	23 33	23 20	22 54	36
40	32 48	33 16	32 00	31 28	31 12	30 40	30 08	29 52	29 36	29 04	28 48	28 16	40
44	39 41	39 02	38 43	38 05	37 46	37 07	36 28	36 09	35 49	35 10	34 51	34 12	44
48	47 14	46 28	46 05	45 18	44 55	44 09	43 23	43 00	42 37	41 51	41 28	40 42	48
52	55 26	54 32	54 05	53 10	52 43	51 49	50 55	50 28	50 01	49 07	48 40	47 46	52
56	64 17	63 14	62 43	61 41	61 10	60 07	59 04	58 33	58 01	56 58	56 27	55 24	56
60	73 48	72 36	72 00	70 48	70 12	69 00	67 48	67 12	66 36	65 24	64 48	63 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.23	1.21	1.20	1.18	1.17	1.15	1.13	1.12	1.11	1.09	1.08	1.06	$\triangle_1$h
Log.	0.089 91	0.082 79	0.079 18	0.071 88	0.068 19	0.060 70	0.053 08	0.049 22	0.045 32	0.037 43	0.033 42	0.025 31	Log.
Limit	67	68	69	70	71	72	73	74	75	76	77	78	Minutes
Meridian	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	...	...	...	...	...	...	...	...	...	0 14	0 14	4
8	1 07	...	...	...	...	...	...	...	...	...	0 57	0 56	8
12	2 31	...	...	...	...	...	...	...	...	...	2 10	2 07	12
16	4 29	...	...	...	...	...	...	...	...	...	3 50	3 45	16
20	7 00	...	...	...	...	...	...	...	...	...	6 00	5 52	20
24	10 05	...	...	...	...	...	...	...	...	...	8 38	8 27	24
28	13 43	...	...	...	...	...	...	...	...	...	11 46	11 30	28
32	17 55	...	...	...	...	...	...	...	...	...	15 22	15 01	32
36	22 41	...	...	...	...	...	...	...	...	...	19 26	19 01	36
40	28 00	...	...	...	...	...	...	...	...	...	24 00	23 28	40
44	33 53	...	...	...	...	...	...	...	...	...	29 02	28 24	44
48	40 19	...	...	...	...	...	...	...	...	...	34 34	33 47	48
52	47 19	...	...	...	...	...	...	...	...	...	40 34	39 39	52
56	54 53	...	...	...	...	...	...	...	...	...	47 02	46 00	56
60	63 00	...	...	...	...	...	...	...	...	...	54 00	52 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.05	...	...	...	...	...	...	...	...	...	0.90	0.88	$\triangle_1$h
Log.	0.021 19	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.954 24	9.944 48	Log.
Limit	79										69	68	Minutes
Meridian	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	0 13	0 13	0 13	0 12	0 12	0 12	0 12	0 12	0 11	0 11	4
8	0 55	0 55	0 54	0 52	0 51	0 51	0 50	0 48	0 47	0 47	0 46	0 45	8
12	2 05	2 04	2 01	1 58	1 55	1 54	1 52	1 48	1 47	1 45	1 44	1 41	12
16	3 43	3 40	3 35	3 30	3 25	3 22	3 19	3 12	3 09	3 07	3 04	2 59	16
20	5 48	5 44	5 36	5 28	5 20	5 16	5 12	5 00	4 56	4 52	4 48	4 40	20
24	8 21	8 16	8 04	7 53	7 41	7 35	7 29	7 12	7 06	7 00	6 55	6 43	24
28	11 22	11 14	10 58	10 43	10 27	10 20	10 12	9 48	9 40	9 33	9 25	9 09	28
32	14 51	14 40	14 20	13 59	13 39	13 29	13 19	12 48	12 38	12 28	12 17	11 57	32
36	18 48	18 35	18 09	17 43	17 17	17 04	16 51	16 12	15 59	15 46	15 33	15 07	36
40	23 12	22 56	22 24	21 52	21 20	21 04	20 48	20 00	19 44	19 28	19 12	18 40	40
44	28 05	27 45	27 06	26 28	25 49	25 29	25 10	24 12	23 52	23 33	23 14	22 35	44
48	33 24	33 01	32 15	31 29	30 43	30 18	29 55	28 46	28 23	28 00	27 37	26 51	48
52	39 12	38 45	37 51	36 57	36 03	35 36	35 09	33 48	33 21	32 54	32 27	31 33	52
56	45 29	44 57	43 54	42 52	41 49	41 17	40 46	39 12	38 40	38 09	37 38	36 35	56
60	52 12	51 36	50 24	49 12	48 00	47 24	46 48	45 00	44 24	43 48	43 12	42 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.87	0.86	0.84	0.82	0.80	0.79	0.77	0.75	0.74	0.73	0.72	0.70	$\Delta_1 h$
Log.	9.939 52	9.934 50	9.924 28	9.913 81	9.903 09	9.897 63	9.886 49	9.875 06	9.869 23	9.863 32	9.857 33	9.845 10	Log.
Limit	67	67	67	67	67	67	68	69	71	72	74	75	Minutes
Meridian	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	0 09	0 08	0 08	0 07	4
8	0 44	0 42	0 40	0 40	0 39	0 38	0 37	0 36	0 35	0 33	0 32	0 31	8
12	1 39	1 36	1 32	1 30	1 27	1 25	1 22	1 21	1 18	1 15	1 12	1 09	12
16	2 57	2 52	2 44	2 42	2 37	2 31	2 26	2 23	2 18	2 13	2 08	2 02	16
20	4 36	4 28	4 16	4 12	4 04	3 56	3 48	3 44	3 36	3 28	3 20	3 12	20
24	6 38	6 26	6 09	6 03	5 52	5 40	5 28	5 23	5 11	5 00	4 48	4 36	24
28	9 01	8 45	8 21	8 14	7 58	7 43	7 27	7 19	7 03	6 48	6 32	6 17	28
32	11 46	11 26	10 55	10 45	10 24	10 04	9 44	9 33	9 13	8 52	8 32	8 12	32
36	14 55	14 29	13 50	13 37	13 11	12 45	12 18	12 06	11 40	11 14	10 48	10 22	36
40	18 24	17 52	17 04	16 48	16 16	15 44	15 12	14 56	14 24	13 52	13 20	12 48	40
44	22 16	21 38	20 39	20 20	19 41	19 02	18 24	18 04	17 25	16 47	16 08	15 29	44
48	26 29	25 43	24 34	24 11	23 25	22 39	21 54	21 30	20 44	19 58	19 12	18 26	48
52	31 05	30 11	28 50	28 23	27 29	26 35	25 41	25 14	24 20	23 26	22 32	21 38	52
56	36 04	35 02	33 27	32 56	31 53	30 50	29 48	29 16	28 13	27 11	26 08	25 05	56
60	41 24	40 12	38 24	37 48	36 36	35 24	34 12	33 36	32 24	31 12	30 00	28 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.69	0.67	0.65	0.63	0.61	0.59	0.57	0.56	0.54	0.52	0.50	0.48	$\Delta_1 h$
Log.	9.838 85	9.826 07	9.812 91	9.799 34	9.785 33	9.770 85	9.755 87	9.748 19	9.732 39	9.716 00	9.698 97	9.681 24	Log.
Limit	76	76	77	78	79	80	80	81	81	82	83	83	Minutes
Meridian	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°	Altitudes

Latitude 50° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 27	0 27	0 28	0 28	0 29	0 30	0 30	0 30	0 30	0 31	4
8	1 45	1 47	1 49	1 50	1 52	1 54	1 56	1 58	2 00	2 01	2 03	2 05	8
12	3 57	4 00	4 05	4 08	4 12	4 17	4 20	4 25	4 29	4 34	4 38	4 44	12
16	7 03	7 08	7 15	7 20	7 28	7 35	7 44	7 51	7 59	8 06	8 14	8 24	16
20	11 00	11 08	11 20	11 28	11 40	11 52	12 04	12 16	12 28	12 40	12 52	13 08	20
24	15 51	16 02	16 19	16 31	16 48	17 05	17 23	17 40	17 57	18 14	18 31	18 54	24
28	21 33	21 49	22 13	22 29	22 52	23 16	23 39	24 02	24 26	24 50	25 14	25 45	28
32	28 09	28 30	29 01	29 21	29 52	30 23	30 53	31 24	31 55	32 26	32 57	33 38	32
36	35 39	36 05	36 43	37 09	37 48	38 27	39 06	39 45	40 24	41 02	41 41	42 33	36
40	44 00	44 32	45 20	45 52	46 40	47 28	48 16	49 04	49 52	50 40	51 28	52 32	40
44	53 15	53 54	54 51	55 30	56 28	57 26	58 24	59 22	60 21	61 18	62 16	63 34	44
48	63 21	64 07	65 15	66 01	67 10	68 19	69 30	70 39	71 48	72 58	74 07	75 39	48
52	74 21	75 15	76 37	77 31	78 52	80 13	81 34	82 55	84 16	85 38	86 59	88 47	52
56	86 15	87 18	88 51	89 54	91 28	93 02	94 36	96 10	97 45	99 18	100 52	102 57	56
60	99 00	100 12	102 00	103 12	105 00	106 48	108 36	110 24	112 12	114 00	. . .	. . .	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.65	1.67	1.70	1.72	1.75	1.78	1.81	1.84	1.87	1.90	1.93	1.97	$\triangle_1 h$
Log.	0.217 48	0.222 72	0.230 45	0.235 53	0.243 04	0.250 42	0.257 68	0.264 82	0.271 84	0.278 75	0.285 56	0.294 47	Log.
Limit	51	51	50	50	49	49	48	47	47	46	46	45	Minutes
Meridian	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	50°	51°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 32	0 33	0 33	0 34	0 35	0 35	0 36	0 37	0 38	0 38	0 39	0 41	4
8	2 09	2 11	2 13	2 16	2 19	2 22	2 26	2 28	2 32	2 36	2 40	2 44	8
12	4 49	4 54	5 00	5 06	5 12	5 20	5 27	5 34	5 41	5 50	5 59	6 09	12
16	8 35	8 42	8 52	9 06	9 16	9 28	9 41	9 54	10 07	10 22	10 37	10 55	16
20	13 24	13 36	13 52	14 12	14 28	14 48	15 08	15 28	15 48	16 12	16 36	17 04	20
24	19 18	19 35	19 58	20 27	20 50	21 19	21 47	22 17	22 45	23 19	23 54	24 35	24
28	26 16	26 39	27 11	27 50	28 21	29 01	29 40	30 19	30 58	31 46	32 33	33 27	28
32	34 18	34 49	35 30	36 21	37 02	37 53	38 45	39 35	40 27	41 29	42 30	43 41	32
36	43 25	44 04	44 56	46 01	46 53	47 57	49 02	50 07	51 12	52 29	53 47	55 18	36
40	53 36	54 24	55 28	56 48	57 52	59 12	60 32	61 52	63 12	64 48	66 24	68 16	40
44	64 51	65 49	67 07	68 44	70 02	71 38	73 15	74 52	76 39	78 24	80 20	82 36	44
48	77 11	78 20	79 52	81 46	83 19	85 15	87 10	89 05	91 00	93 19	95 37	. . .	48
52	90 35	91 56	93 44	95 59	97 47	100 03	102 18	104 33	106 48	. . .	. . .	. . .	52
56	105 03	106 37	108 43	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	56
60	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.01	2.04	2.08	2.13	2.17	2.22	2.27	2.32	2.37	2.43	2.49	2.56	$\triangle_1 h$
Log.	0.303 20	0.309 63	0.318 06	0.328 38	0.336 46	0.346 35	0.356 03	0.365 49	0.374 75	0.385 61	0.396 20	0.408 24	Log.
Limit	44	44	43	43	42	41	41	40	40	39	38	37	Minutes
Meridian	52°	53°	54°	55°	56°	57°	58°	59°	60°	61°	62°	63°	Altitudes

Latitude 50° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 42	0 43	0 44	0 46	0 47	0 49	0 51	0 53	0 55	0 58	1 01	1 03	4
8	2 48	2 54	2 59	3 04	3 10	3 17	3 25	3 32	3 42	3 51	4 03	4 15	8
12	6 18	6 30	6 42	6 55	7 08	7 24	7 41	7 58	8 19	8 41	9 07	9 35	12
16	11 14	11 34	11 54	12 17	12 40	13 08	13 39	14 10	14 45	15 27	16 13	17 01	16
20	17 32	18 04	18 36	19 12	19 48	20 32	21 20	22 08	23 04	24 08	25 20	26 36	20
24	25 15	26 01	26 47	27 39	28 30	29 34	30 43	31 53	33 13	34 46	36 29	38 18	24
28	34 22	35 25	36 28	37 38	38 49	40 15	41 49	43 23	45 13	47 18	49 39	52 09	28
32	44 53	46 15	47 37	49 09	50 42	52 34	54 37	56 39	59 03	61 46	64 51	68 06	32
36	56 49	58 32	60 16	62 13	64 09	66 32	69 07	71 43	...	...	...	...	36
40	70 08	72 16	74 24	76 48	...	...	...	...	...	...	...	...	40
44	84 52	87 26	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.63	2.71	2.79	2.88	2.97	3.08	3.20	3.32	3.46	3.62	3.80	3.99	$\triangle_1 h$
Log.	0.419 96	0.432 97	0.445 60	0.459 39	0.472 76	0.488 55	0.505 15	0.521 14	0.539 08	0.558 71	0.579 78	0.600 97	Log.
Limit	36	35	34	33	32	31	30	29	28	28	27	26	Minutes
Meridian	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 07	1 12	1 17	1 23	1 29	1 37	1 48	2 01	2 19	2 44	...	...	4
8	4 30	4 47	5 06	5 29	5 57	6 30	7 12	8 05	9 16	10 56	...	...	8
12	10 08	10 46	11 29	12 20	13 22	14 37	16 11	18 10	20 51	24 35	...	...	12
16	18 00	19 06	20 23	21 56	23 46	25 59	28 45	32 18	37 05	43 41	...	...	16
20	28 08	29 52	31 52	34 16	37 08	40 36	44 56	50 28	...	...	...	...	20
24	40 31	42 59	45 53	49 21	53 28	58 28	...	...	...	...	...	...	24
28	55 09	58 33	62 26	67 09	...	...	...	...	...	...	...	...	28
32	72 01	76 28	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.22	4.48	4.78	5.14	5.57	6.09	6.74	7.57	8.69	10.24	...	...	$\triangle_1 h$
Log.	0.625 31	0.651 28	0.679 43	0.710 96	0.745 86	0.784 62	0.828 66	0.879 10	0.939 02	1.010 30	... ...	... ...	Log.
Limit	26	25	24	22	21	20	18	16	14	13	10	7	Minutes
Meridian	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	Altitudes

Latitude 50° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	2 13	1 49	1 31	1 17	1 07	4
8	...	...	...	...	...	...	...	8 52	7 12	6 01	5 08	4 26	8
12	...	...	...	...	...	...	...	19 56	16 12	13 32	11 32	9 59	12
16	...	...	...	...	...	...	...	35 28	28 48	24 04	20 32	17 45	16
20	...	...	...	...	...	...	...	...	...	37 36	32 04	27 44	20
24	...	...	...	...	...	...	...	...	...	...	46 11	39 57	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	...	...	...	8.31	6.75	5.64	4.81	4.16	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.919 60	0.829 30	0.751 28	0.682 15	0.619 09	Log.
Limit	5	3	0	3	6	8	10	12	14	16	18	21	Minutes
Meridian	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 58	0 51	0 46	0 41	0 36	0 33	0 30	0 27	0 24	0 22	0 20	0 18	4
8	3 52	3·26	3 02	2 43	2 27	2 12	1 59	1 48	1 38	1 29	1 21	1 12	8
12	8 42	7 42	6 50	6 07	5 30	4 57	4 28	4 03	3 40	3 20	3 02	2 42	12
16	15 30	13 42	12 10	10 53	9 46	8 47	7 56	7 13	6 32	5 56	5 22	4 50	16
20	24 12	21 24	19 00	17 00	15 16	13 44	12 24	11 16	10 12	9 16	8 24	7 32	20
24	34 51	30 49	27 22	24 29	21 59	19 47	17 52	16 14	14 41	13 21	12 06	10 51	24
28	47 26	41 57	37 14	33 19	29 56	26 55	24 18	22 05	20 00	18 10	16 28	14 46	28
32	...	54 47	48 38	43 31	39 05	35 09	31 44	28 50	26 07	23 43	21 30	19 17	32
36	...	...	...	55 05	49 28	44 30	40 11	36 31	33 03	30 02	27 13	24 25	36
40	...	...	...	...	...	54 56	49 36	45 04	40 48	37 04	33 36	30 08	40
44	...	...	...	...	...	...	...	54 32	49 22	44 51	40 39	36 28	44
48	...	...	...	...	...	...	...	64 53	58 45	53 22	48 23	43 23	48
52	...	...	...	...	...	...	...	...	...	62 38	56 47	50 55	52
56	...	...	...	...	...	...	...	...	...	...	65 51	59 04	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	3.63	3.21	2.85	2.55	2.29	2.06	1.86	1.69	1.53	1.39	1.26	1.13	$\triangle_1$h
Log.	0.559 91	0.506 51	0.454 84	0.406 54	0.359 84	0.313 87	0.269 51	0.227 89	0.184 69	0.143 01	0.100 37	0.053 08	Log.
Limit	24	26	28	30	32	34	36	38	41	43	46	48	Minutes
Meridian	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	69°	Altitudes

Latitude 50° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 26	0 26	0 25	0 25	0 24	0 24	0 23	0 23	0 23	0 22	0 22	4
8	1 45	1 43	1 42	1 41	1 40	1 38	1 36	1 36	1 34	1 33	1 33	1 31	8
12	3 57	3 53	3 50	3 48	3 45	3 40	3 37	3 35	3 32	3 29	3 28	3 25	12
16	7 03	6 55	6 50	6 44	6 39	6 32	6 27	6 21	6 16	6 11	6 08	6 03	16
20	11 00	10 48	10 40	10 32	10 24	10 12	10 04	9 56	9 48	9 40	9 36	9 28	20
24	15 51	15 34	15 22	15 10	14 59	14 41	14 30	14 18	14 06	13 55	13 49	13 38	24
28	21 33	21 10	20 54	20 39	20 23	20 00	19 44	19 29	19 13	18 57	18 49	18 34	28
32	28 09	27 38	27 18	26 58	26 37	26 07	25 46	25 26	25 06	24 45	24 35	24 14	32
36	35 39	35 00	34 34	34 08	33 42	33 03	32 37	32 11	31 45	31 19	31 06	30 40	36
40	44 00	43 12	42 40	42 08	41 36	40 48	40 16	39 44	39 12	38 40	38 24	37 52	40
44	53 15	52 17	51 38	50 59	50 20	49 22	48 43	48 04	47 26	46 47	46 27	45 49	44
48	63 21	62 12	61 26	60 40	59 54	58 45	57 59	57 13	56 27	55 41	55 18	54 32	48
52	74 21	73 00	72 06	71 12	70 18	68 57	68 03	67 09	66 15	65 21	64 54	64 00	52
56	86 15	84 41	83 38	82 35	81 32	79 58	78 55	77 52	76 50	75 37	75 15	74 13	56
60	99 00	97 12	96 00	94 48	93 36	91 48	90 36	89 24	88 12	87 00	86 24	85 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.65	1.62	1.60	1.58	1.56	1.53	1.51	1.49	1.47	1.45	1.44	1.42	$\triangle_1$h
Log.	0.217 48	0.209 52	0.204 12	0.198 66	0.193 12	0.184 69	0.178 98	0.173 19	0.167 32	0.161 37	0.158 36	0.152 29	Log.
Limit	51	51	52	53	54	55	55	55	56	57	58	58	Minutes
Meridian	40°	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 22	0 21	0 21	0 20	0 20	0 20	0 20	0 19	0 19	4
8	1 30	1 28	1 27	1 26	1 25	1 23	1 23	1 22	1 21	1 20	1 19	1 17	8
12	3 22	3 19	3 16	3 14	3 11	3 08	3 06	3 05	3 02	3 00	2 57	2 54	12
16	5 58	5 53	5 48	5 46	5 41	5 36	5 30	5 27	5 22	5 20	5 15	5 10	16
20	9 20	9 12	9 04	9 00	8 52	8 44	8 36	8 32	8 24	8 20	8 12	8 04	20
24	13 26	13 15	13 04	12 58	12 46	12 35	12 23	12 17	12 06	12 00	11 48	11 37	24
28	18 18	18 02	17 46	17 38	17 23	17 07	16 52	16 44	16 28	16 20	16 05	15 49	28
32	23 54	23 33	23 12	23 02	22 42	22 21	22 01	21 51	21 30	21 20	21 00	20 39	32
36	30 14	29 49	29 23	29 10	28 44	28 18	27 52	27 39	27 13	27 00	26 34	26 08	36
40	37 20	36 48	36 16	36 00	35 28	34 56	34 24	34 08	33 36	33 20	32 48	32 16	40
44	45 10	44 32	43 53	43 34	42 55	42 16	41 37	41 18	40 39	40 20	39 41	39 02	44
48	53 46	52 59	52 13	51 50	51 04	50 18	49 32	49 09	48 23	48 00	47 14	46 28	48
52	63 06	62 11	61 17	60 50	59 56	59 02	58 08	57 41	56 47	56 20	55 26	54 32	52
56	73 10	72 08	71 05	70 34	69 31	68 28	67 25	66 54	65 51	65 20	64 17	63 14	56
60	84 00	82 48	81 36	81 00	79 48	78 36	77 24	76 48	75 36	75 00	73 48	72 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.40	1.38	1.36	1.35	1.33	1.31	1.29	1.28	1.26	1.25	1.23	1.21	$\triangle_1$h
Log.	0.146 13	0.139 88	0.133 54	0.130 33	0.123 85	0.117 27	0.110 59	0.107 21	0.100 37	0.096 91	0.089 91	0.082 79	Log.
Limit	59	60	61	62	62	62	63	64	65	65	66	67	Minutes
Meridian	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	Altitudes

Latitude 50° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 19	0 19	0 18	0 18	0 17	0 17	0 17	0 17	0 17	4
8	1 17	1 15	1 14	1 13	1 13	1 11	1 11	1 10	1 09	1 08	1 07	1 07	8
12	2 53	2 50	2 47	2 45	2 44	2 41	2 39	2 37	2 36	2 33	2 31	2 30	12
16	5 07	5 02	4 57	4 55	4 52	4 47	4 45	4 39	4 36	4 31	4 29	4 26	16
20	8 00	7 52	7 44	7 40	7 36	7 28	7 24	7 16	7 12	7 04	7 00	6 56	20
24	11 31	11 20	11 09	11 03	10 57	10 46	10 40	10 28	10 22	10 11	10 05	9 59	24
28	15 41	15 25	15 09	15 01	14 53	14 38	14 30	14 15	14 07	13 51	13 43	13 35	28
32	20 29	20 08	19 47	19 37	19 27	19 06	18 56	18 36	18 26	18 05	17 55	17 45	32
36	25 55	25 30	25 04	24 51	24 38	24 12	23 59	23 33	23 20	22 54	22 41	22 28	36
40	32 00	31 28	30 56	30 40	30 24	29 52	29 36	29 04	28 48	28 16	28 00	27 44	40
44	38 43	38 05	37 26	37 07	36 47	36 09	35 49	35 10	34 51	34 12	33 53	33 33	44
48	46 05	45 18	44 52	44 09	43 46	43 00	42 37	41 51	41 28	40 42	40 19	39 56	48
52	54 05	53 10	52 16	51 49	51 22	50 28	50 01	49 07	48 40	47 46	47 19	46 52	52
56	62 43	61 41	60 38	60 07	59 35	58 33	58 01	56 58	56 27	55 24	54 53	54 21	56
60	72 00	70 48	69 36	69 00	68 24	67 12	66 36	65 24	64 48	63 36	63 00	62 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.20	1.18	1.16	1.15	1.14	1.12	1.11	1.09	1.08	1.06	1.05	1.04	$\Delta_1 h$
Log.	0.079 18	0.071 88	0.064 46	0.060 70	0.056 90	0.049 22	0.045 32	0.037 43	0.033 42	0.025 31	0.021 19	0.017 03	Log.
Limit	68	69	70	71	72	73	74	75	76	77	78	80	Minutes
Meridian	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	...	0 14	0 14	0 14	4
8	...	...	...	...	...	...	...	...	...	0 57	0 56	0 55	8
12	...	...	...	...	...	...	...	...	...	2 10	2 07	2 04	12
16	...	...	...	...	...	...	...	...	...	3 50	3 45	3 40	16
20	...	...	...	...	...	...	...	...	...	6 00	5 52	5 44	20
24	...	...	...	...	...	...	...	...	...	8 38	8 27	8 16	24
28	...	...	...	...	...	...	...	...	...	11 46	11 30	11 14	28
32	...	...	...	...	...	...	...	...	...	15 22	15 01	14 40	32
36	...	...	...	...	...	...	...	...	...	19 26	19 01	18 35	36
40	...	...	...	...	...	...	...	...	...	24 00	23 28	22 56	40
44	...	...	...	...	...	...	...	...	...	29 02	28 24	27 45	44
48	...	...	...	...	...	...	...	...	...	34 34	33 47	33 01	48
52	...	...	...	...	...	...	...	...	...	40 34	39 39	38 45	52
56	...	...	...	...	...	...	...	...	...	47 02	46 00	44 57	56
60	...	...	...	...	...	...	...	...	...	54 00	52 48	51 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	...	...	...	...	...	...	0.90	0.88	0.86	$\Delta_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.954 24	9.944 48	9.934 50	Log.
Limit										70	69	68	Minutes
Meridian	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	Altitudes

Latitude 50° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 13	0 13	0 13	0 12	0 12	0 12	0 12	0 11	0 11	0 11	0 11	4
8	0 54	0 54	0 52	0 51	0 51	0 50	0 49	0 47	0 47	0 46	0 45	0 44	8
12	2 02	2 01	1 58	1 55	1 54	1 52	1 50	1 47	1 45	1 44	1 42	1 39	12
16	3 38	3 35	3 30	3 25	3 22	3 19	3 14	3 09	3 07	3 04	3 02	2 57	16
20	5 40	5 36	5 28	5 20	5 16	5 12	5 04	4 56	4 52	4 48	4 44	4 36	20
24	8 10	8 04	7 53	7 41	7 35	7 29	7 18	7 06	7 00	6 55	6 49	6 38	24
28	11 06	10 58	10 43	10 27	10 20	10 12	9 56	9 40	9 33	9 25	9 17	9 01	28
32	14 30	14 20	13 59	13 39	13 29	13 19	12 58	12 38	12 28	12 17	12 07	11 46	32
36	18 22	18 09	17 43	17 17	17 04	16 51	16 25	15 59	15 46	15 33	15 20	14 55	36
40	22 40	22 24	21 52	21 20	21 04	20 48	20 16	19 44	19 28	19 12	18 56	18 24	40
44	27 26	27 06	26 28	25 49	25 29	25 10	24 31	23 52	23 33	23 14	22 54	22 16	44
48	32 38	32 15	31 29	30 43	30 18	29 55	29 09	28 23	28 00	27 37	27 14	26 29	48
52	38 18	37 51	36 57	36 03	35 36	35 09	34 15	33 21	32 54	32 27	32 00	31 05	52
56	44 26	43 54	42 52	41 49	41 17	40 46	39 43	38 40	38 09	37 38	37 06	36 04	56
60	51 00	50 24	49 12	48 00	47 24	46 48	45 36	44 24	43 48	43 12	42 36	41 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	0.85	0.84	0.82	0.80	0.79	0.78	0.76	0.74	0.73	0.72	0.71	0.69	△₁h
Log.	9.929 42	9.924 28	9.913 81	9.903 09	9.897 63	9.892 09	9.880 81	9.869 23	9.863 32	9.857 33	9.851 26	9.838 85	Log.
Limit	67	67	67	67	67	68	68	69	70	71	72	73	Minutes
Meridian	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 10	0 10	0 09	0 09	0 09	0 09	0 08	0 08	0 07	4
8	0 43	0 42	0 40	0 39	0 39	0 38	0 37	0 36	0 35	0 33	0 32	0 31	8
12	1 37	1 35	1 32	1 29	1 27	1 25	1 22	1 21	1 18	1 15	1 12	1 09	12
16	2 54	2 49	2 44	2 39	2 37	2 31	2 26	2 23	2 18	2 13	2 08	2 02	16
20	4 32	4 24	4 16	4 08	4 04	3 56	3 48	3 44	3 36	3 28	3 20	3 12	20
24	6 32	6 21	6 09	5 58	5 52	5 40	5 28	5 23	5 11	5 00	4 48	4 36	24
28	8 53	8 37	8 21	8 06	7 58	7 43	7 27	7 19	7 03	6 48	6 32	6 17	28
32	11 36	11 15	10 55	10 34	10 24	10 04	9 44	9 33	9 13	8 52	8 32	8 12	32
36	14 42	14 16	13 50	13 24	13 11	12 45	12 18	12 06	11 40	11 14	10 48	10 22	36
40	18 08	17 36	17 04	16 32	16 16	15 44	15 12	14 56	14 24	13 52	13 20	12 48	40
44	21 57	21 18	20 39	20 01	19 41	19 02	18 24	18 04	17 25	16 47	16 08	15 29	44
48	26 08	25 20	24 34	23 48	23 25	22 39	21 54	21 30	20 44	19 58	19 12	18 26	48
52	30 38	29 44	28 50	27 56	27 29	26 35	25 41	25 14	24 20	23 26	22 32	21 38	52
56	35 33	34 30	33 27	32 25	31 53	30 50	29 48	29 16	28 13	27 11	26 08	25 05	56
60	40 48	39 36	38 24	37 12	36 36	35 24	34 12	33 36	32 24	31 12	30 00	28 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	0.68	0.66	0.64	0.62	0.61	0.59	0.57	0.56	0.54	0.52	0.50	0.48	△₁h
Log.	9.832 51	9.819 54	9.806 18	9.792 39	9.785 33	9.770 85	9.755 87	9.748 19	9.732 39	9.716 00	9.698 97	9.681 24	Log.
Limit	74	75	76	77	78	79	80	81	81	82	82	82	Minutes
Meridian	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°	31°	Altitudes

Latitude 51° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 26	0 27	0 27	0 27	0 27	0 28	0 28	0 28	0 29	0 30	0 30	4
8	1 42	1 42	1 45	1 46	1 48	1 50	1 52	1 54	1 55	1 56	1 58	2 01	8
12	3 49	3 51	3 56	3 59	4 03	4 06	4 11	4 16	4 18	4 22	4 26	4 32	12
16	6 47	6 53	7 00	7 05	7 13	7 18	7 25	7 33	7 38	7 46	7 54	8 04	16
20	10 36	10 44	10 56	11 04	11 16	11 24	11 36	11 48	11 56	12 08	12 20	12 36	20
24	15 16	15 28	15 45	15 57	16 14	16 25	16 42	16 59	17 11	17 29	17 46	18 09	24
28	20 47	21 02	21 25	21 41	22 05	22 21	22 44	23 08	23 24	23 47	24 10	24 42	28
32	27 08	27 28	27 59	28 19	28 50	29 11	29 42	30 13	30 33	31 03	31 34	32 15	32
36	34 21	34 47	35 26	35 52	36 31	36 56	37 35	38 14	38 40	39 19	39 58	40 50	36
40	42 24	42 56	43 44	44 16	45 04	45 36	46 24	47 12	47 44	48 32	49 20	50 24	40
44	51 18	51 57	52 55	53 34	54 32	55 10	56 08	57 07	57 45	58 44	59 42	60 59	44
48	61 03	61 49	62 58	63 44	64 53	65 38	66 47	67 56	68 42	69 53	71 02	72 34	48
52	71 39	72 33	73 54	74 48	76 09	77 04	78 25	79 46	80 40	82 01	83 22	85 10	52
56	83 06	84 09	85 43	86 46	88 20	89 22	90 56	92 31	93 33	95 08	96 42	98 47	56
60	95 24	96 36	98 24	99 36	101 24	102 36	104 24	106 12	107 24	109 12	111 00	113 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.59	1.61	1.64	1.66	1.69	1.71	1.74	1.77	1.79	1.82	1.85	1.89	$\Delta_1 h$
Log.	0.201 40	0.206 83	0.214 84	0.220 11	0.227 89	0.233 00	0.240 55	0.247 97	0.252 85	0.260 07	0.267 17	0.276 46	Log.
Limit	53	52	51	51	50	50	49	48	48	47	47	46	Minutes
Meridian	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	50°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 31	0 31	0 32	0 33	0 34	0 35	0 35	0 36	0 37	0 38	0 38	4
8	2 02	2 05	2 07	2 10	2 13	2 15	2 18	2 21	2 24	2 28	2 31	2 35	8
12	4 37	4 43	4 47	4 52	4 58	5 03	5 11	5 17	5 24	5 32	5 40	5 49	12
16	8 11	8 21	8 29	8 40	8 50	9 01	9 13	9 23	9 36	9 52	10 04	10 19	16
20	12 48	13 04	13 16	13 32	13 48	14 04	14 24	14 40	15 00	15 24	15 44	16 08	20
24	18 26	18 49	19 06	19 29	19 52	20 16	20 45	21 07	21 36	22 11	22 40	23 14	24
28	25 06	25 37	26 01	26 32	27 03	27 34	28 13	28 45	29 24	30 11	30 50	31 38	28
32	32 46	33 27	33 58	34 39	35 20	36 00	36 51	37 33	38 24	39 25	40 16	41 18	32
36	41 28	42 20	42 59	43 51	44 43	45 35	46 40	47 31	48 36	49 54	50 59	52 16	36
40	51 12	52 16	53 04	54 08	55 12	56 16	57 36	58 40	60 00	61 36	62 56	64 32	40
44	61 57	63 14	64 12	65 30	66 48	68 05	69 42	70 59	72 36	74 32	76 09	78 05	44
48	73 44	75 16	76 25	77 57	79 29	81 01	82 56	84 29	86 24	88 42	90 37	92 56	48
52	86 32	88 20	89 41	91 29	93 17	95 05	97 20	99 09	101 24	104 06	106 21	. . .	52
56	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	56
60	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.92	1.96	1.99	2.03	2.07	2.11	2.16	2.20	2.25	2.31	2.36	2.42	$\Delta_1 h$
Log.	0.283 30	0.292 26	0.298 85	0.307 50	0.315 97	0.324 28	0.334 45	0.342 42	0.352 18	0.363 61	0.372 91	0.383 82	Log.
Limit	46	45	45	44	44	43	42	42	41	40	39	38	Minutes
Meridian	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	61°	62°	Altitudes

Latitude 51° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 40	0 41	0 42	0 43	0 44	0 46	0 47	0 50	0 51	0 54	0 56	0 59	4
8	2 40	2 44	2 48	2 54	2 59	3 05	3 11	3 18	3 26	3 34	3 44	3 55	8
12	5 59	6 09	6 18	6 30	6 42	6 56	7 11	7 26	7 44	8 02	8 24	8 48	12
16	10 37	10 55	11 14	11 34	11 54	12 20	12 45	13 14	13 44	14 18	14 56	15 40	16
20	16 36	17 04	17 32	18 04	18 36	19 16	19 56	20 40	21 28	22 20	23 20	24 28	20
24	23 54	24 35	46 15	26 01	26 47	27 45	28 42	29 46	30 55	32 10	33 36	35 14	24
28	32 33	33 27	34 22	35 25	36 28	37 46	39 05	40 30	42 05	43 46	45 44	47 57	28
32	42 30	43 41	44 53	46 15	47 37	49 19	51 02	52 54	54 57	57 10	59 44	62 38	32
36	53 47	55 18	56 49	58 32	60 16	62 26	64 35	66 58	69 33	72 22	...	...	36
40	66 24	68 16	70 08	72 16	74 24	77 04	79 44	...	...	...	...	...	40
44	80 20	82 56	84 52	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.49	2.56	2.63	2.71	2.79	2.89	2.99	3.10	3.22	3.35	3.50	3.67	$\triangle_1 h$
Log.	0.396 20	0.408 24	0.419 96	0.432 97	0.445 60	0.460 90	0.475 67	0.491 36	0.507 86	0.525 04	0.544 07	0.564 67	Log.
Limit	37	36	35	34	33	33	32	31	30	29	28	28	Minutes
Meridian	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 02	1 05	1 09	1 14	1 19	1 26	1 34	1 43	1 56	2 14	2 38	...	4
8	4 07	4 21	4 37	4 55	5 17	5 44	6 16	6 56	7 47	8 54	10 30	...	8
12	9 16	9 48	10 23	11 05	11 55	12 53	14 05	15 35	17 30	20 02	23 38	...	12
16	16 28	17 24	18 29	19 43	21 09	22 55	25 03	27 41	31 06	35 38	42 02	...	16
20	25 44	27 12	28 52	30 48	33 04	35 48	39 08	43 16	48 36	...	...	...	20
24	37 04	39 10	41 34	44 22	47 37	51 33	56 21	...	...	...	...	...	24
28	50 26	53 19	56 35	60 22	64 49	...	...	...	...	...	...	...	28
32	65 52	69 38	73 53	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.86	4.08	4.33	4.62	4.96	5.37	5.87	6.49	7.29	8.35	9.85	...	$\triangle_1 h$
Log.	0.586 59	0.610 66	0.636 49	0.664 64	0.695 48	0.729 97	0.768 64	0.812 24	0.862 73	0.921 69	0.993 44	... ...	Log.
Limit	27	26	25	24	22	21	19	17	15	14	13	11	Minutes
Meridian	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	Altitudes

Latitude 51° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	2 06	1 43	1 26	1 13	4
8	...	...	...	...	...	...	...	...	8 27	6 53	5 44	4 53	8
12	...	...	...	...	...	...	...	...	19 02	15 28	12 53	10 58	12
16	...	...	...	...	...	...	...	...	33 50	27 28	22 15	19 30	16
20	...	...	...	...	...	...	...	...	...	...	35 48	30 28	20
24	...	...	...	...	...	...	...	...	...	...	...	43 52	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	...	7.93	6.44	5.37	4.57	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.899 27	0.808 89	0.729 97	0.659 92	Log.
Limit	9	6	3	0	3	6	8	10	12	14	16	19	Minutes
Meridian	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 03	0 55	0 49	0 43	0 38	0 35	0 31	0 28	0 26	0 23	0 21	0 19	4
8	4 13	3 41	3 15	2 53	2 35	2 18	2 04	1 52	1 41	1 32	1 23	1 15	8
12	9 31	8 17	7 18	6 29	5 47	5 11	4 40	4 12	3 48	3 24	3 07	2 48	12
16	16 53	14 43	12 58	11 31	10 17	9 13	8 16	7 28	6 44	6 06	5 33	5 00	16
20	26 24	23 00	20 16	18 00	16 04	14 24	12 56	11 40	10 32	9 32	8 40	7 48	20
24	38 01	33 07	29 11	25 55	23 08	20 45	18 37	16 48	15 10	13 43	12 29	11 14	24
28	...	45 05	39 43	35 17	31 30	28 13	25 21	22 52	20 39	18 42	16 59	15 17	28
32	...	...	...	46 05	41 08	36 51	33 07	29 52	26 58	24 25	22 11	19 58	32
36	...	...	...	...	52 03	46 40	41 54	37 48	34 08	30 53	28 05	25 17	36
40	...	...	...	...	...	57 36	51 44	46 40	42 08	38 08	34 40	31 12	40
44	...	...	...	...	...	...	...	56 28	50 59	46 08	41 57	37 46	44
48	...	...	...	...	...	...	...	...	60 40	54 55	49 55	44 55	48
52	...	...	...	...	...	...	...	...	...	64 27	58 35	52 43	52
56	...	...	...	...	...	...	...	...	...	...	67 57	61 10	56
60	...	...	...	...	...	...	...	...	...	...	...	70 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.96	3.45	3.04	2.70	2.41	2.16	1.94	1.75	1.58	1.43	1.30	1.17	$\triangle_1 h$
Log.	0.597 70	0.537 82	0.482 87	0.431 36	0.382 02	0.334 45	0.287 80	0.243 04	0.198 66	0.155 34	0.113 94	0.068 19	Log.
Limit	22	24	26	28	30	33	35	38	41	43	45	47	Minutes
Meridian	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	70°	Altitudes

Declinations.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 25	0 25	0 24	0 24	0 23	0 23	0 23	0 22	0 22	0 22	0 22	4
8	1 42	1 41	1 39	1 38	1 36	1 35	1 34	1 33	1 32	1 30	1 29	1 28	8
12	3 49	3 46	3 43	3 40	3 36	3 34	3 32	3 29	3 24	3 23	3 20	3 17	12
16	6 47	6 42	6 37	6 32	6 24	6 18	6 16	6 11	6 06	6 01	5 56	5 51	16
20	10 36	10 28	10 20	10 12	10 00	9 52	9 48	9 40	9 32	9 24	9 16	9 08	20
24	15 16	15 04	14 53	14 41	14 24	14 12	14 06	13 55	13 43	13 32	13 21	13 09	24
28	20 47	20 31	20 15	20 00	19 36	19 21	19 13	18 57	18 42	18 26	18 10	17 54	28
32	27 08	26 48	26 27	26 07	25 36	25 16	25 06	24 45	24 25	24 04	23 43	23 23	32
36	34 21	33 55	33 29	33 03	32 24	31 58	31 45	31 19	30 53	30 27	30 02	29 36	36
40	42 24	41 52	41 20	40 48	40 00	39 28	39 12	38 40	38 08	37 36	37 04	36 32	40
44	51 18	50 40	50 01	49 22	48 24	47 45	47 26	46 47	46 08	45 29	44 51	44 13	44
48	61 03	60 17	59 31	58 45	57 36	56 50	56 27	55 41	54 55	54 09	53 22	52 36	48
52	71 39	70 45	69 51	68 57	67 36	66 42	66 15	65 21	64 27	63 33	62 38	61 44	52
56	83 06	82 04	81 01	79 58	78 24	77 21	76 50	75 37	74 44	73 41	72 39	71 37	56
60	95 24	94 12	93 00	91 48	90 00	88 48	88 12	87 00	85 48	84 36	83 24	82 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.59	1.57	1.55	1.53	1.50	1.48	1.47	1.45	1.43	1.41	1.39	1.37	$\triangle_1 h$
Log.	0.201 40	0.195 90	0.190 33	0.184 69	0.176 09	0.170 26	0.167 32	0.161 37	0.155 34	0.149 22	0.143 01	0.136 72	Log.
Limit	53	53	54	54	55	56	56	56	57	58	59	59	Minutes
Meridian	39°	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	Altitudes

Declinations.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Anglos
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 21	0 21	0 20	0 20	0 20	0 20	0 19	0 19	0 19	0 19	4
8	1 27	1 26	1 24	1 23	1 23	1 21	1 21	1 20	1 19	1 17	1 17	1 15	8
12	3 16	3 13	3 10	3 08	3 06	3 03	3 02	2 59	2 57	2 54	2 53	2 50	12
16	5 48	5 43	5 38	5 36	5 30	5 25	5 22	5 17	5 15	5 10	5 07	5 02	16
20	9 04	8 56	8 48	8 44	8 36	8 28	8 24	8 16	8 12	8 04	8 00	7 52	20
24	13 04	12 52	12 41	12 35	12 23	12 11	12 06	11 54	11 48	11 37	11 31	11 20	24
28	17 46	17 30	17 15	17 07	16 52	16 36	16 28	16 12	16 05	15 49	15 41	15 25	28
32	23 12	22 52	22 31	22 21	22 01	21 41	21 30	21 10	21 00	20 39	20 29	20 08	32
36	29 23	28 57	28 31	28 18	27 52	27 26	27 13	26 47	26 34	26 08	25 55	25 30	36
40	36 16	35 44	35 12	34 56	34 24	33 52	33 36	33 04	32 48	32 16	32 00	31 28	40
44	43 53	43 14	42 36	42 16	41 37	40 59	40 39	40 00	39 41	39 02	38 43	38 05	44
48	52 13	51 27	50 41	50 18	49 32	48 46	48 23	47 37	47 14	46 28	46 05	45 18	48
52	61 17	60 23	59 29	59 02	58 08	57 14	56 47	55 53	55 26	54 32	54 05	53 10	52
56	71 05	70 02	69 00	68 28	67 25	66 23	65 51	64 48	64 17	63 14	62 43	61 41	56
60	81 36	80 24	79 12	78 36	77 24	76 12	75 36	74 24	73 48	72 36	72 00	70 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.36	1.34	1.32	1.31	1.29	1.27	1.26	1.24	1.23	1.21	1.20	1.18	$\triangle_1 h$
Log.	0.133 54	0.127 10	0.120 57	0.117 27	0.110 59	0.103 80	0.100 37	0.093 42	0.089 91	0.082 79	0.079 18	0.071 88	Log.
Limit	60	61	62	63	63	63	64	65	66	67	68	69	Minutes
Meridian	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	Altitudes

Latitude 51° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 18	0 18	0 18	0 17	0 17	0 17	0 17	0 16	...	4
8	1 15	1 13	1 12	1 11	1 11	1 10	1 09	1 08	1 07	1 07	1 06	...	8
12	2 48	2 45	2 42	2 41	2 39	2 38	2 36	2 33	2 31	2 30	2 28	...	12
16	5 00	4 55	4 50	4 47	4 45	4 42	4 36	4 31	4 29	4 26	4 24	...	16
20	7 48	7 40	7 32	7 28	7 24	7 20	7 12	7 04	7 00	6 56	6 52	...	20
24	11 14	11 03	10 51	10 46	10 40	10 34	10 22	10 11	10 05	9 59	9 53	...	24
28	15 17	15 01	14 46	14 38	14 30	14 22	14 07	13 51	13 43	13 35	13 28	...	28
32	19 58	19 37	19 17	19 06	18 56	18 46	18 26	18 05	17 55	17 45	17 35	...	32
36	25 17	24 51	24 25	24 12	23 59	23 46	23 20	22 54	22 41	22 28	22 15	...	36
40	31 12	30 40	30 08	29 52	29 36	29 20	28 48	28 16	28 00	27 44	27 28	...	40
44	37 46	37 07	36 28	36 09	35 49	35 30	34 51	34 12	33 53	33 33	33 14	...	44
48	44 55	44 09	43 23	43 00	42 37	42 14	41 28	40 42	40 19	39 56	39 33	...	48
52	52 43	51 49	50 55	50 28	50 01	49 34	48 40	47 46	47 19	46 52	46 25	...	52
56	61 10	60 07	59 04	58 33	58 01	57 30	56 27	55 24	54 53	54 21	53 50	...	56
60	70 12	69 00	67 48	67 12	66 36	66 00	64 48	63 36	63 00	62 24	61 48	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.17	1.15	1.13	1.12	1.11	1.10	1.08	1.06	1.05	1.04	1.03	...	Δ_1h
Log.	0.068 19	0.060 70	0.053 08	0.049 22	0.045 32	0.041 39	0.033 42	0.025 31	0.021 19	0.017 03	0.012 84	... ...	Log.
Limit	70	70	71	72	73	74	75	76	77	78	79		Minutes
Meridian	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	0 14	0 14	0 14	0 14	4
8	...	...	...	...	...	...	...	...	0 57	0 56	0 55	0 54	8
12	...	...	...	...	...	...	...	...	2 08	2 07	2 04	2 02	12
16	...	...	...	...	...	...	...	...	3 48	3 45	3 40	3 38	16
20	...	...	...	...	...	...	...	...	5 56	5 52	5 44	5 40	20
24	...	...	...	...	...	...	...	...	8 33	8 27	8 16	8 10	24
28	...	...	...	...	...	...	...	...	11 38	11 30	11 14	11 06	28
32	...	...	...	...	...	...	...	...	15 11	15 01	14 40	14 30	32
36	...	...	...	...	...	...	...	...	19 14	19 01	18 35	18 22	36
40	...	...	...	...	...	...	...	...	23 44	23 28	22 56	22 40	40
44	...	...	...	...	...	...	...	...	28 43	28 24	27 45	27 26	44
48	...	...	...	...	...	...	...	...	34 10	33 47	33 01	32 38	48
52	...	...	...	...	...	...	...	...	40 06	39 39	38 45	38 18	52
56	...	...	...	...	...	...	...	...	46 31	46 00	44 57	44 26	56
60	...	...	...	...	...	...	...	...	53 24	52 48	51 36	51 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	...	...	...	...	...	...	...	...	0.89	0.88	0.86	0.85	Δ_1h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.949 39	9.944 48	9.934 50	9.929 42	Log.
Limit									72	72	72	72	Minutes
Meridian	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 13	0 13	0 12	0 12	0 12	0 12	0 12	0 11	0 11	0 11	0 11	4
8	0 54	0 52	0 51	0 51	0 50	0 49	0 48	0 47	0 46	0 46	0 45	0 43	8
12	2 01	1 58	1 55	1 54	1 53	1 50	1 48	1 45	1 44	1 42	1 41	1 38	12
16	3 35	3 30	3 25	3 22	3 19	3 14	3 12	3 07	3 04	3 02	2 59	2 54	16
20	5 36	5 28	5 20	5 16	5 12	5 04	5 00	4 52	4 48	4 44	4 40	4 32	20
24	8 04	7 53	7 41	7 35	7 29	7 18	7 12	7 00	6 55	6 49	6 43	6 32	24
28	10 58	10 43	10 27	10 20	10 12	9 56	9 48	9 33	9 25	9 17	9 09	8 53	28
32	14 20	13 59	13 39	13 29	13 19	12 58	12 48	12 28	12 17	12 07	11 57	11 36	32
36	18 09	17 43	17 17	17 04	16 51	16 25	16 12	15 46	15 33	15 20	15 07	14 42	36
40	22 24	21 52	21 20	21 04	20 48	20 16	20 00	19 28	19 12	18 56	18 40	18 08	40
44	27 06	26 28	25 49	25 29	25 10	24 31	24 12	23 33	23 14	22 54	22 35	21 57	44
48	32 15	31 29	30 43	30 18	29 55	29 09	28 46	28 00	27 37	27 14	26 51	26 06	48
52	37 51	36 57	36 03	35 36	35 09	34 15	33 48	32 54	32 27	32 00	31 33	30 38	52
56	43 54	42 52	41 49	41 17	40 46	39 44	39 12	38 09	37 38	37 06	36 35	35 33	56
60	50 24	49 12	48 00	47 24	46 48	45 36	45 00	43 48	43 12	42 36	42 00	40 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.84	0.82	0.80	0.79	0.78	0.76	0.75	0.73	0.72	0.71	0.70	0.68	$\Delta_1 h$
Log.	9.924 28	9.913 81	9.903 09	9.897 63	9.892 09	9.880 81	9.875 06	9.863 32	9.857 33	9.851 26	9.845 10	9.832 51	Log.
Limit	72	72	72	72	72	72	72	72	72	72	72	72	Minutes
Meridian	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 10	0 10	0 10	0 09	0 09	0 09	0 09	0 08	0 08	0 07	4
8	0 42	0 41	0 40	0 40	0 39	0 38	0 37	0 36	0 35	0 34	0 32	0 30	8
12	1 36	1 33	1 30	1 27	1 26	1 24	1 21	1 19	1 16	1 13	1 11	1 08	12
16	2 52	2 47	2 42	2 37	2 34	2 28	2 23	2 21	2 16	2 11	2 05	2 00	16
20	4 28	4 20	4 12	4 04	4 00	3 52	3 44	3 40	3 32	3 24	3 16	3 08	20
24	6 26	6 15	6 03	5 52	5 46	5 34	5 23	5 17	5 05	4 54	4 42	4 30	24
28	8 45	8 29	8 14	7 58	7 50	7 35	7 19	7 11	6 56	6 40	6 25	6 09	28
32	11 26	11 05	10 45	10 24	10 14	9 54	9 33	9 23	9 03	8 42	8 22	8 02	32
36	14 29	14 03	13 37	13 11	12 58	12 32	12 06	11 53	11 27	11 01	10 35	10 09	36
40	17 52	17 20	16 48	16 16	16 00	15 28	14 56	14 40	14 08	13 36	13 04	12 32	40
44	21 38	20 59	20 20	19 41	19 22	18 43	18 04	17 45	17 06	16 27	15 48	15 10	44
48	25 43	24 57	24 11	23 25	23 02	22 16	21 30	21 07	20 21	19 35	18 49	18 03	48
52	30 11	29 17	28 23	27 29	27 02	26 08	25 14	24 47	23 53	22 59	22 05	21 11	52
56	35 02	33 59	32 56	31 53	31 22	30 19	29 16	28 45	27 42	26 39	25 36	24 34	56
60	40 12	39 00	37 48	36 36	36 00	34 48	33 36	33 00	31 48	30 36	29 24	28 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.67	0.65	0.63	0.61	0.60	0.58	0.56	0.55	0.53	0.51	0.49	0.47	$\Delta_1 h$
Log.	9.826 07	9.812 91	9.799 34	9.785 33	9.778 15	9.763 43	9.748 19	9.740 36	9.724 28	9.707 57	9.690 20	9.672 10	Log.
Limit	73	74	75	76	77	78	79	80	81	82	82	82	Minutes
Meridian	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	Altitudes

Latitude 52° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 24	0 25	0 25	0 26	0 26	0 27	0 27	0 27	0 27	0 28	0 28	0 29	4
8	1 38	1 40	1 41	1 42	1 43	1 45	1 47	1 49	1 50	1 52	1 54	1 56	8
12	3 40	3 45	3 48	3 50	3 53	3 57	4 00	4 05	4 08	4 12	4 17	4 20	12
16	6 32	6 39	6 44	6 50	6 55	7 03	7 08	7 15	7 20	7 28	7 35	7 44	16
20	10 12	10 24	10 32	10 40	10 48	11 00	11 08	11 20	11 28	11 40	11 52	12 04	20
24	14 41	14 59	15 10	15 22	15 34	15 51	16 02	16 19	16 31	16 48	17 05	17 23	24
28	20 00	20 23	20 39	20 54	21 10	21 33	21 49	22 13	22 29	22 52	23 16	23 39	28
32	26 07	26 37	26 58	27 18	27 38	28 09	28 30	29 01	29 21	29 52	30 23	30 53	32
36	33 03	33 42	34 08	34 34	35 00	35 39	36 05	36 43	37 09	37 48	38 27	39 06	36
40	40 48	41 36	42 08	42 40	43 12	44 00	44 32	45 20	45 52	46 40	47 28	48 16	40
44	49 22	50 20	50 59	51 38	52 17	53 15	53 54	54 51	55 30	56 28	57 26	58 24	44
48	58 45	59 54	60 40	61 26	62 12	63 21	64 07	65 15	66 01	67 10	68 19	69 30	48
52	68 57	70 18	71 12	72 06	73 00	74 21	75 15	76 37	77 31	78 52	80 13	81 34	52
56	79 58	81 32	82 35	83 38	84 41	86 15	87 18	88 51	89 54	91 28	93 02	94 36	56
60	91 48	93 36	94 48	96 00	97 12	99 00	100 12	102 00	103 12	105 00	106 48	108 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.53	1.56	1.58	1.60	1.62	1.65	1.67	1.70	1.72	1.75	1.78	1.81	$\Delta_1 h$
Log.	0.184 69	0.193 12	0.198 66	0.204 12	0.209 52	0.217 48	0.222 72	0.230 45	0.235 53	0.243 04	0.250 42	0.257 68	Log.
Limit	54	53	52	52	51	51	50	50	49	49	48	48	Minutes
Meridian	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 30	0 30	0 31	0 31	0 32	0 33	0 34	0 35	0 35	0 36	0 37	4
8	1 58	2 00	2 02	2 04	2 06	2 09	2 12	2 14	2 17	2 20	2 24	2 27	8
12	4 25	4 29	4 35	4 40	4 46	4 51	4 57	5 02	5 08	5 15	5 23	5 31	12
16	7 51	7 59	8 09	8 16	8 26	8 37	8 47	8 58	9 08	9 21	9 33	9 49	16
20	12 16	12 28	12 44	12 56	13 12	13 28	13 44	14 00	14 16	14 36	14 56	15 20	20
24	17 40	17 57	18 20	18 37	19 00	19 24	19 47	20 10	20 33	21 02	21 30	30 03	24
28	24 02	24 26	24 58	25 21	25 53	26 24	26 55	27 26	27 57	28 37	29 16	39 15	28
32	31 24	31 55	32 36	33 07	33 48	34 28	35 09	35 50	36 31	37 22	38 14	49 41	32
36	39 45	40 24	41 15	41 54	42 46	43 38	44 30	45 22	46 14	47 19	48 23	61 20	36
40	49 04	49 52	50 56	51 44	52 48	53 52	54 56	56 00	57 04	58 24	59 44	74 13	40
44	59 22	60 21	61 37	62 35	63 53	65 11	66 28	67 46	69 03	70 40	72 16	88 19	44
48	70 39	71 48	73 21	74 30	76 02	77 34	79 06	80 38	82 10	84 05	86 01	103 39	48
52	82 55	84 16	86 05	87 26	89 14	91 02	92 50	94 38	96 26	98 41	100 57	...	52
56	96 10	97 45	99 49	101 23	103 29	105 34	...	...	...	...	...	...	56
60	110 24	112 12	114 36	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.84	1.87	1.91	1.94	1.98	2.02	2.06	2.10	2.14	2.19	2.24	2.30	$\Delta_1 h$
Log.	0.264 82	0.271 84	0.281 03	0.287 80	0.296 67	0.305 35	0.313 87	0.322 22	0.330 41	0.340 44	0.350 25	0.361 73	Log.
Limit	47	47	46	46	45	44	43	43	42	41	40	39	Minutes
Meridian	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	61°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 38	0 39	0 41	0 42	0 43	0 44	0 46	0 48	0 50	0 52	0 54	4
8	2 30	2 35	2 39	2 43	2 47	2 54	2 59	3 05	3 12	3 19	3 28	3 37	8
12	5 38	5 47	5 58	6 07	6 17	6 30	6 42	6 56	7 12	7 27	7 47	8 08	12
16	10 02	10 17	10 34	10 53	11 11	11 34	11 54	12 20	12 48	13 17	13 49	14 28	16
20	15 40	16 04	16 32	17 00	17 28	18 04	18 36	19 16	20 00	20 44	21 36	22 36	20
24	22 34	23 08	23 48	24 29	25 10	26 01	26 57	27 45	28 48	29 52	31 06	32 33	24
28	30 42	31 30	32 25	33 19	34 14	35 25	36 28	37 46	39 12	40 38	42 20	44 18	28
32	40 06	41 08	42 20	43 31	44 42	46 15	47 37	49 19	51 12	53 04	55 18	57 51	32
36	50 46	52 03	53 34	55 05	56 36	58 32	60 16	62 26	64 48	67 11	69 59	73 14	36
40	62 40	64 16	66 08	68 00	69 52	72 16	74 24	77 04	80 00	...	...	...	40
44	75 50	77 45	80 01	82 17	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.35	2.41	2.48	2.55	2.62	2.71	2.79	2.89	3.00	3.11	3.24	3.39	$\triangle_1 h$
Log.	0.371 07	0.382 02	0.394 45	0.406 54	0.418 30	0.432 97	0.445 60	0.460 90	0.477 12	0.492 76	0.510 55	0.530 20	Log.
Limit	38	38	37	36	35	34	33	32	31	30	29	29	Minutes
Meridian	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 57	0 59	1 03	1 07	1 11	1 16	1 23	1 31	1 40	1 52	2 08	2 31	4
8	3 47	4 00	4 12	4 27	4 45	5 06	5 31	6 01	6 40	7 29	8 34	10 06	8
12	8 31	8 57	9 28	10 02	10 41	11 29	12 24	13 33	15 00	16 49	19 14	22 43	12
16	15 09	15 55	16 48	17 50	18 59	20 23	22 04	24 07	26 40	29 55	34 16	40 21	16
20	23 40	24 52	26 16	27 52	29 40	31 52	34 28	37 40	41 40	46 44	53 32	...	20
24	34 05	35 48	37 49	40 08	42 43	45 53	49 38	54 15	60 00	...	...	...	24
28	46 23	48 45	51 29	54 37	58 09	62 26	67 33	...	...	...	...	...	28
32	60 35	63 40	67 15	71 20	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.55	3.73	3.94	4.18	4.45	4.78	5.17	5.65	6.25	7.01	8.03	9.46	$\triangle_1 h$
Log.	0.550 23	0.571 71	0.595 50	0.621 18	0.648 36	0.679 43	0.713 49	0.752 05	0.795 88	0.845 72	0.904 72	0.975 89	Log.
Limit	28	27	26	25	24	23	22	20	18	16	14	12	Minutes
Meridian	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	Altitudes

Latitude 52° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	...	2 01	1 38	1 22	4
8	...	...	...	...	...	...	...	...	...	8 03	6 32	5 27	8
12	...	...	...	...	...	...	...	...	...	18 07	14 42	12 15	12
16	...	...	...	...	...	...	...	...	...	32 13	26 10	21 49	16
20	...	...	...	...	...	...	...	...	...	...	40 52	34 04	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	...	...	7.55	6.13	5.11	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.877 95	0.787 46	0.708 42	Log.
Limit	10	8	5	3	0	3	6	8	11	13	16	18	Minutes
Meridian	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 10	1 00	0 52	0 46	0 41	0 36	0 32	0 29	0 27	0 23	0 22	0 19	4
8	4 38	4 00	3 30	3 04	2 43	2 25	2 10	1 56	1 45	1 35	1 26	1 17	8
12	10 25	9 00	7 51	6 55	6 07	5 26	4 52	4 22	3 56	3 34	3 13	2 53	12
16	18 31	16 00	13 57	12 17	10 53	9 38	8 40	7 46	7 00	6 18	5 43	5 07	16
20	28 56	25 00	21 48	19 12	17 00	15 04	13 32	12 08	10 56	9 52	8 56	8 00	20
24	41 40	36 00	31 23	27 39	24 29	21 42	19 29	17 29	15 45	14 12	12 52	11 31	24
28	...	...	42 44	37 38	33 19	29 32	26 32	23 47	21 25	19 21	17 30	15 41	28
32	...	...	...	49 09	43 31	38 24	34 39	31 03	27 59	25 16	22 52	20 29	32
36	...	...	...	...	...	48 49	43 51	39 19	35 26	31 58	28 57	25 55	36
40	...	...	...	...	...	...	54 08	48 32	43 44	39 28	35 44	32 00	40
44	...	...	...	...	...	...	...	58 44	52 55	47 45	43 14	38 43	44
48	...	...	...	...	...	...	...	...	62 58	56 50	51 27	46 05	48
52	...	...	...	...	...	...	...	...	...	...	60 23	54 05	52
56	...	...	...	...	...	...	...	...	...	...	...	62 43	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.34	3.75	3.27	2.88	2.55	2.26	2.03	1.82	1.64	1.48	1.34	1.20	$\triangle_1 h$
Log.	0.637 49	0.574 03	0.514 55	0.459 39	0.406 54	0.354 11	0.307 50	0.260 07	0.214 84	0.170 26	0.127 10	0.079 18	Log.
Limit	20	22	24	27	29	31	34	36	39	41	44	47	Minutes
Meridian	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	71°	Altitudes

Latitude 52° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 24	0 24	0 23	0 23	0 23	0 22	0 22	0 22	0 22	0 22	0 22	0 21	4
8	1 38	1 36	1 36	1 34	1 33	1 33	1 31	1 30	1 28	1 28	1 26	1 25	8
12	3 40	3 37	3 35	3 32	3 29	3 28	3 25	3 22	3 19	3 17	3 14	3 11	12
16	6 32	6 27	6 21	6 16	6 11	6 08	6 03	5 58	5 53	5 51	5 46	5 41	16
20	10 12	10 04	9 56	9 48	9 40	9 36	9 28	9 20	9 12	9 08	9 00	8 52	20
24	14 41	14 30	14 18	14 06	13 55	13 49	13 38	13 26	13 15	13 09	12 58	12 46	24
28	20 00	19 44	19 29	19 13	18 57	18 49	18 34	18 18	18 02	17 54	17 38	17 23	28
32	26 07	25 46	25 26	25 06	24 45	24 35	24 14	23 54	23 33	23 23	23 02	22 42	32
36	33 03	32 37	32 11	31 45	31 19	31 06	30 40	30 14	29 49	29 36	29 10	28 44	36
40	40 48	40 16	39 44	39 12	38 40	38 24	37 52	37 20	36 48	36 32	36 00	35 28	40
44	49 22	48 43	48 04	47 26	46 47	46 27	45 49	45 10	44 32	44 13	43 34	42 55	44
48	58 45	57 59	57 13	56 27	55 41	55 18	54 32	53 46	52 59	52 36	51 50	51 04	48
52	68 57	68 03	67 09	66 15	65 21	64 54	64 00	63 06	62 11	61 44	60 50	59 56	52
56	79 58	78 55	77 52	76 50	75 37	75 15	74 13	73 10	72 08	71 37	70 34	69 31	56
60	91 48	90 36	89 24	88 12	87 00	86 24	85 12	84 00	82 48	82 12	81 00	79 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.53	1.51	1.49	1.47	1.45	1.44	1.42	1.40	1.38	1.37	1.35	1.33	$\triangle_1$h
Log.	0.184 69	0.178 98	0.173 19	0.167 32	0.161 37	0.158 36	0.152 29	0.146 13	0.139 88	0.136 72	0.130 33	0.123 85	Log.
Limit	53	54	55	55	56	57	57	58	59	60	61	61	Minutes
Meridian	38°	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 21	0 21	0 20	0 20	0 20	0 20	0 19	0 19	0 19	0 19	0 19	0 19	4
8	1 24	1 23	1 22	1 21	1 20	1 20	1 18	1 17	1 16	1 15	1 15	1 13	8
12	3 10	3 07	3 05	3 03	3 00	2 59	2 56	2 54	2 51	2 50	2 48	2 45	12
16	5 38	5 33	5 27	5 25	5 20	5 17	5 12	5 10	5 05	5 02	5 00	4 55	16
20	8 48	8 40	8 32	8 28	8 20	8 16	8 08	8 04	7 56	7 52	7 48	7 40	20
24	12 41	12 29	12 17	12 11	12 00	11 54	11 43	11 37	11 26	11 20	11 14	11 03	24
28	17 15	16 59	16 44	16 36	16 20	16 12	15 57	15 49	15 33	15 25	15 17	15 01	28
32	22 31	22 11	21 51	21 41	21 20	21 10	20 49	20 39	20 18	20 08	19 58	19 37	32
36	28 31	28 05	27 39	27 26	27 00	26 47	26 21	26 08	25 43	25 30	25 17	24 51	36
40	35 12	34 40	34 08	33 52	33 20	33 04	32 32	32 16	31 44	31 28	31 12	30 40	40
44	42 36	41 57	41 18	40 59	40 20	40 00	39 22	39 02	38 24	38 05	37 46	37 07	44
48	50 41	49 55	49 09	48 46	48 00	47 37	46 51	46 28	45 41	45 18	44 55	44 09	48
52	59 29	58 35	57 41	57 14	56 20	55 53	54 59	54 32	53 37	53 10	52 43	51 49	52
56	69 00	67 57	66 54	66 23	65 20	64 48	63 46	63 14	62 12	61 41	61 10	60 07	56
60	79 12	78 00	76 48	76 12	75 00	74 24	73 12	72 36	71 24	70 48	70 12	69 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.32	1.32	1.28	1.27	1.25	1.24	1.22	1.21	1.19	1.18	1.17	1.15	$\triangle_1$h
Log.	0.120 57	0.113 94	0.107 21	0.103 80	0.096 91	0.093 42	0.086 36	0.082 79	0.075 55	0 071 88	0.068 19	0.060 70	Log.
Limit	62	63	64	64	64	64	65	66	67	68	69	70	Minutes
Meridian	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	Altitudes

Latitude 52° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 18	0 18	0 17	0 17	0 17	0 17	0 17	0 17	0 16	...	...	4
8	1 13	1 11	1 10	1 10	1 09	1 09	1 07	1 07	1 06	1 05	...	...	8
12	2 44	2 41	2 38	2 37	2 35	2 34	2 31	2 30	2 28	2 27	...	...	12
16	4 52	4 47	4 42	4 39	4 36	4 34	4 29	4 26	4 24	4 21	...	...	16
20	7 36	7 28	7 20	7 16	7 12	7 08	7 00	6 56	6 52	6 48	...	...	20
24	10 57	10 46	10 34	10 28	10 22	10 16	10 05	9 59	9 53	9 48	...	...	24
28	14 53	14 38	14 22	14 15	14 07	13 59	13 43	13 35	13 28	13 20	...	...	28
32	19 27	19 06	18 46	18 36	18 26	18 16	17 55	17 45	17 35	17 24	...	...	32
36	24 38	24 12	23 46	23 33	23 20	23 07	22 41	22 28	22 15	22 02	...	...	36
40	30 24	29 52	29 20	29 04	28 48	28 32	28 00	27 44	27 28	27 12	...	...	40
44	36 47	36 09	35 30	35 10	34 51	34 32	33 53	33 33	33 14	32 55	...	...	44
48	43 46	43 00	42 14	41 51	41 28	41 05	40 19	39 56	39 33	39 10	...	...	48
52	51 22	50 28	49 34	49 07	48 40	48 13	47 19	46 52	46 25	45 58	...	...	52
56	59 35	58 33	57 30	56 58	56 27	55 56	54 53	54 21	53 50	53 19	...	...	56
60	68 24	67 12	66 00	65 24	64 48	64 12	63 00	62 24	61 48	61 12	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.14	1.12	1.10	1.09	1.08	1.07	1.05	1.04	1.03	1.02	...	...	$\triangle_1 h$
Log.	0.056 90	0.049 22	0.041 39	0.037 43	0.033 42	0.029 38	0.021 19	0.017 03	0.012 84	0.008 60	... ...	... ...	Log.
Limit	71	71	72	73	74	75	76	77	78	79			Minutes
Meridian	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	0 14	0 14	0 14	0 14	0 14	4
8	...	...	...	...	...	...	...	0 56	0 56	0 55	0 54	0 53	8
12	...	...	...	...	...	...	...	2 07	2 05	2 04	2 02	1 59	12
16	...	...	...	...	...	...	...	3 45	3 43	3 40	3 38	3 33	16
20	...	...	...	...	...	...	...	5 52	5 48	5 44	5 40	5 32	20
24	...	...	...	...	...	...	...	8 27	8 21	8 16	8 10	7 58	24
28	...	...	...	...	...	...	...	11 30	11 22	11 14	11 06	10 51	28
32	...	...	...	...	...	...	...	15 01	14 51	14 40	14 30	14 10	32
36	...	...	...	...	...	...	...	19 01	18 48	18 35	18 22	17 56	36
40	...	..	...	...	...	...	...	23 28	23 12	22 56	22 40	22 08	40
44	...	..	...	...	...	...	...	28 24	28 05	27 45	27 26	26 47	44
48	...	..	...	...	...	...	...	33 47	33 24	33 01	32 38	31 52	48
52	...	..	...	...	...	...	...	39 39	39 12	38 45	38 18	37 24	52
56	...	...	...	...	...	...	...	46 00	45 29	44 57	44 26	43 23	56
60	...	...	...	...	...	...	...	52 48	52 12	51 36	51 00	49 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	0.88	0.87	0.86	0.85	0.83	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.944 48	9.939 52	9.934 50	9.929 42	9.919 08	Log.
Limit								74	74	74	74	74	Minutes
Meridian	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	Altitudes

Latitude 52° Declination Contrary Name.

Declinations. — Inferior Meridian.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 13	0 13	0 12	0 12	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 11	4
8	0 52	0 51	0 51	0 50	0 50	0 48	0 48	0 46	0 46	0 45	0 44	0 43	8
12	1 58	1 55	1 54	1 53	1 51	1 48	1 47	1 44	1 42	1 41	1 39	1 36	12
16	3 30	3 25	3 22	3 19	3 17	3 12	3 09	3 04	3 02	2 59	2 57	2 52	16
20	5 28	5 20	5 16	5 12	5 08	5 00	4 56	4 48	4 44	4 40	4 36	4 28	20
24	7 53	7 41	7 35	7 29	7 23	7 12	7 06	6 55	6 49	6 43	6 38	6 26	24
28	10 43	10 27	10 20	10 12	10 04	9 48	9 40	9 25	9 17	9 09	9 01	8 45	28
32	13 59	13 39	13 29	13 19	13 09	12 48	12 38	12 17	12 07	11 57	11 46	11 26	32
36	17 43	17 17	17 04	16 51	16 38	16 12	15 59	15 33	15 20	15 07	14 55	14 29	36
40	21 52	21 20	21 04	20 48	20 32	20 00	19 44	19 12	18 56	18 40	18 24	17 52	40
44	26 28	25 49	25 29	25 10	24 51	24 12	23 52	23 14	22 54	22 35	22 16	21 38	44
48	31 29	30 43	30 18	29 55	29 32	28 46	28 23	27 37	27 14	26 51	26 29	25 43	48
52	36 57	36 03	35 36	35 09	34 42	33 48	33 21	32 27	32 00	31 33	31 05	30 11	52
56	42 52	41 49	41 17	40 46	40 15	39 12	38 40	37 38	37 07	36 35	36 04	35 02	56
60	49 12	48 00	47 24	46 48	46 12	45 00	44 24	43 12	42 36	42 00	41 24	40 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.82	0.80	0.79	0.78	0.77	0.75	0.74	0.72	0.71	0.70	0.69	0.67	$\Delta_1 h$
Log.	9.913 81	9.903 09	9.897 63	9.892 09	9.886 49	9.875 06	9.869 23	9.857 33	9.851 26	9.845 10	9.838 85	9.826 07	Log.
Limit	74	74	74	74	74	74	74	74	74	74	74	74	Minutes
Meridian	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	Altitudes

Declinations. — Inferior Meridian.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 10	0 10	0 09	0 09	0 09	0 09	0 09	0 08	0 08	0 07	4
8	0 42	0 40	0 40	0 38	0 38	0 37	0 36	0 35	0 33	0 32	0 32	0 30	8
12	1 35	1 32	1 29	1 26	1 25	1 22	1 21	1 18	1 15	1 13	1 11	1 08	12
16	2 49	2 44	2 39	2 34	2 31	2 26	2 23	2 18	2 13	2 11	2 05	2 00	16
20	4 24	4 16	4 08	4 00	3 56	3 48	3 44	3 36	3 28	3 24	3 16	3 08	20
24	6 21	6 09	5 58	5 46	5 40	5 28	5 23	5 11	5 00	4 54	4 42	4 30	24
28	8 37	8 21	8 06	7 50	7 43	7 27	7 19	7 03	6 48	6 40	6 25	6 09	28
32	11 15	10 55	10 34	10 14	10 04	9 44	9 33	9 13	8 52	8 42	8 22	8 02	32
36	14 16	13 50	13 24	12 58	12 45	12 19	12 06	11 40	11 14	11 01	10 35	10 09	36
40	17 36	17 04	16 32	16 00	15 44	15 12	14 56	14 24	13 52	13 36	13 04	12 32	40
44	21 18	20 39	20 01	19 22	19 02	18 24	18 04	17 25	16 47	16 27	15 48	15 10	44
48	25 20	24 34	23 48	23 02	22 39	21 53	21 30	20 44	19 58	19 35	18 49	18 03	48
52	29 44	28 50	27 56	27 02	26 35	25 41	25 14	24 20	23 26	22 59	22 05	21 11	52
56	34 30	33 27	32 25	31 22	30 50	29 48	29 16	28 13	27 11	26 39	25 36	24 34	56
60	39 36	38 24	37 12	36 00	35 24	34 12	33 36	32 24	31 12	30 36	29 24	28 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.66	0.64	0.62	0.60	0.59	0.57	0.56	0.54	0.52	0.51	0.49	0.47	$\Delta_1 h$
Log.	9.819 54	9.806 18	9.792 39	9.778 15	7.770 85	9.755 87	9.748 19	9.732 39	9.716 00	9.707 57	9.690 20	9.672 10	Log.
Limit	74	74	74	74	76	77	78	79	80	81	81	81	Minutes
Meridian	22°	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	Altitudes

Latitude 53° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 24	0 24	0 25	0 25	0 25	0 26	0 26	0 27	0 27	0 27	0 27	4
8	1 35	1 36	1 37	1 39	1 40	1 41	1 42	1 44	1 45	1 47	1 50	1 51	8
12	3 34	3 36	3 39	3 42	3 45	3 48	3 51	3 54	3 57	4 02	4 06	4 09	12
16	6 18	6 24	6 29	6 34	6 39	6 44	6 53	6 58	7 03	7 10	7 18	7 23	16
20	9 52	10 00	10 08	10 16	10 24	10 32	10 44	10 52	11 00	11 12	11 24	11 32	20
24	14 12	14 24	14 36	14 47	14 59	15 10	15 28	15 39	15 51	16 08	16 25	16 36	24
28	19 21	19 36	19 52	20 07	20 23	20 39	21 02	21 18	21 33	21 57	22 21	22 37	28
32	25 16	25 36	25 56	26 17	26 37	26 58	27 28	27 49	28 09	28 40	29 11	29 32	32
36	31 58	32 24	32 50	33 16	33 42	34 08	34 47	35 13	35 39	36 18	36 56	37 22	36
40	39 28	40 00	40 32	41 04	41 36	42 08	42 56	43 28	44 00	44 48	45 36	46 08	40
44	47 45	48 24	49 03	49 41	50 20	50 59	51 57	52 36	53 15	54 13	55 10	55 49	44
48	56 50	57 36	58 22	59 08	59 54	60 40	61 49	62 35	63 21	64 30	65 38	66 24	48
52	66 42	67 36	68 30	69 24	70 18	71 12	72 33	73 27	74 21	75 42	77 04	77 58	52
56	77 21	78 24	79 27	80 29	81 32	82 35	84 09	85 12	86 15	87 49	89 22	90 25	56
60	88 48	90 00	91 12	92 24	93 36	94 48	96 36	97 48	99 00	100 48	102 36	103 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.48	1.50	1.52	1.54	1.56	1.58	1.61	1.63	1.65	1.68	1.71	1.73	$\triangle_1 h$
Log.	0.170 26	0.176 09	0.181 84	0.187 52	0.193 12	0.198 66	0.206 83	0.212 19	0.217 48	0.225 31	0.233 00	0.238 05	Log.
Limit	55	55	54	54	53	52	52	51	51	50	49	49	Minutes
Meridian	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 28	0 29	0 30	0 30	0 30	0 31	0 32	0 33	0 33	0 34	0 35	4
8	1 53	1 55	1 56	1 58	2 01	2 02	2 05	2 08	2 11	2 13	2 16	2 19	8
12	4 14	4 18	4 22	4 26	4 32	4 37	4 43	4 48	4 54	5 00	5 06	5 14	12
16	7 30	7 38	7 46	7 54	8 04	8 11	8 21	8 32	8 42	8 52	9 06	9 18	16
20	11 44	11 56	12 08	12 20	12 36	12 48	13 04	13 20	13 36	13 52	14 12	14 32	20
24	16 54	17 11	17 29	17 46	18 09	18 26	18 49	19 12	19 35	19 58	20 27	20 56	24
28	23 00	23 24	23 47	24 10	24 42	25 06	25 37	26 08	26 39	27 11	27 50	28 29	28
32	30 02	30 33	31 03	31 34	32 15	32 46	33 27	34 08	34 49	35 30	36 21	37 12	32
36	38 01	38 40	39 19	39 58	40 50	41 28	42 20	43 12	44 04	44 56	46 01	47 06	36
40	46 56	47 44	48 32	49 20	50 24	51 12	52 16	53 20	54 24	55 28	56 48	58 08	40
44	56 47	57 45	58 44	59 42	60 59	61 57	63 14	64 32	65 49	67 07	68 44	70 21	44
48	67 33	68 42	69 53	71 02	72 34	73 44	75 16	76 48	78 20	79 52	81 46	83 42	48
52	79 19	80 40	82 01	83 22	85 10	86 32	88 20	90 08	91 56	93 44	95 59	98 14	52
56	91 59	93 33	95 08	96 42	98 47	100 21	102 26	104 32	106 37	...	...	...	56
60	105 36	107 24	109 12	111 00	113 24	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.76	1.79	1.82	1.85	1.89	1.92	1.96	2.00	2.04	2.08	2.13	2.18	$\triangle_1 h$
Log.	0.245 51	0.252 85	0.260 07	0.267 17	0.276 46	0.283 30	0.292 26	0.301 03	0.309 63	0.318 06	0.328 38	0.338 46	Log.
Limit	48	47	46	46	45	44	44	43	43	42	41	40	Minutes
Meridian	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 35	0 36	0 38	0 39	0 39	0 41	0 43	0 44	0 45	0 47	0 48	0 50	4
8	2 23	2 25	2 30	2 33	2 38	2 42	2 49	2 54	2 59	3 06	3 12	3 21	8
12	5 21	5 27	5 37	5 45	5 57	6 06	6 18	6 30	6 43	6 57	7 12	7 33	12
16	9 31	9 40	10 00	10 15	10 31	10 51	11 10	11 30	11 57	12 22	12 48	13 27	16
20	14 52	15 08	15 36	16 00	16 28	16 56	17 28	18 00	18 39	19 19	19 59	21 00	20
24	21 24	21 47	22 27	23 03	23 42	24 24	25 10	25 55	26 52	27 49	28 48	30 15	24
28	29 09	29 40	30 33	31 21	32 17	33 11	34 15	35 18	36 35	37 54	39 12	41 09	28
32	38 03	38 45	39 56	40 57	42 10	43 20	44 42	46 05	47 47	49 30	51 12	53 45	32
36	48 10	49 02	50 33	51 50	53 21	54 52	56 36	58 19	60 29	62 38	64 48	68 03	36
40	59 28	60 32	62 24	64 00	65 52	67 44	69 52	72 00	74 40	77 20	...	...	40
44	71 57	73 15	75 30	77 26	79 42	81 57	...	...	...	...	...	...	44
48	85 38	87 10	89 51	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.23	2.27	2.34	2.40	2.47	2.54	2.62	2.70	2.80	2.90	3.00	3.13	△₁h
Log.	0.348 30	0.356 03	0.369 22	0.380 21	0.392 70	0.404 83	0.418 30	0.431 36	0.447 16	0.462 40	0.477 12	0.495 54	Log.
Limit	40	39	38	37	36	35	34	34	33	32	31	30	Minutes
Meridian	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 52	0 55	0 58	1 01	1 04	1 08	1 14	1 20	1 27	1 36	1 48	2 03	4
8	3 29	3 38	3 50	4 03	4 17	4 35	4 55	5 19	5 48	6 24	7 12	8 13	8
12	7 50	8 12	8 38	9 07	9 39	10 19	11 03	11 56	13 03	14 24	16 11	18 30	12
16	13 56	14 35	15 22	16 13	17 09	18 18	19 38	21 12	23 11	25 36	28 44	32 54	16
20	21 48	22 48	24 00	25 19	26 48	28 36	30 40	33 08	36 16	40 00	44 56	...	20
24	31 23	32 50	34 34	36 28	38 36	41 11	44 10	47 42	52 13	57 36	...	...	24
28	42 44	44 41	47 02	49 39	52 32	56 04	60 06	64 57	...	...	...	...	28
32	55 49	58 22	61 26	64 51	68 36	...	...	...	...	...	...	...	32
36	70 38	73 52	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	3.27	3.42	3.60	3.80	4.02	4.29	4.60	4.97	5.44	6.00	6.74	7.71	△₁h
Log.	0.514 55	0.534 03	0.556 30	0.579 78	0.604 23	0.632 46	0.662 76	0.696 36	0.735 60	0.778 15	0.828 66	0.887 05	Log.
Limit	30	29	28	26	25	25	23	22	20	18	17	15	Minutes
Meridian	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	Altitudes

Latitude 53° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	2 25	...	...	...	...	...	...	...	...	...	1 55	1 34	4
8	9 41	...	...	...	...	...	...	...	...	...	7 41	6 16	8
12	21 46	...	...	...	...	...	...	...	...	...	17 15	14 06	12
16	38 42	...	...	...	...	...	...	...	...	...	30 41	25 04	16
20	...	...	...	...	...	...	...	...	...	...	47 56	39 12	20
24	...	...	...	...	...	...	...	...	...	...	...	56 27	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	9.07	...	...	...	...	...	...	...	...	...	7.19	5.88	$\triangle_1 h$
Log.	0.957 61	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.856 73	0.769 38	Log.
Limit	13	11	8	6	3	0	3	5	8	11	14	16	Minutes
Meridian	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 18	1 06	0 57	0 49	0 44	0 39	0 35	0 30	0 27	0 25	0 22	0 19	4
8	5 11	4 23	3 47	3 18	2 54	2 33	2 17	2 02	1 50	1 39	1 28	1 18	8
12	11 39	9 52	8 30	7 25	6 31	5 45	5 08	4 35	4 06	3 42	3 19	2 56	12
16	20 41	17 34	15 09	13 10	11 37	10 15	9 08	8 09	7 18	6 34	5 53	5 12	16
20	32 20	27 28	23 40	20 36	18 07	16 00	14 16	12 44	11 24	10 16	9 12	8 08	20
24	46 34	39 34	34 05	29 40	26 07	23 03	20 33	18 20	16 25	14 47	13 15	11 43	24
28	...	53 50	46 16	40 23	35 33	31 21	27 57	24 58	22 21	20 07	18 02	15 57	28
32	...	...	...	52 44	46 24	40 57	36 31	32 36	29 11	26 17	23 33	20 49	32
36	...	...	...	...	...	51 50	46 14	41 15	36 56	33 16	29 49	26 21	36
40	...	...	...	...	...	...	...	50 56	45 36	41 04	36 48	32 32	40
44	...	...	...	...	...	...	...	...	55 10	49 41	44 32	39 22	44
48	...	...	...	...	...	...	...	...	...	59 08	52 59	46 51	48
52	...	...	...	...	...	...	...	...	...	...	62 11	54 59	52
56	...	...	...	...	...	...	...	...	...	...	...	63 46	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.85	4.12	3.55	3.09	2.72	2.40	2.14	1.91	1.71	1.54	1.38	1.22	$\triangle_1 h$
Log.	0.685 74	0.614 90	0.550 23	0.489 96	0.434 57	0.380 21	0.330 41	0.281 03	0.233 00	0.187 52	0.139 88	0.086 36	Log.
Limit	18	21	23	25	27	29	32	34	37	39	43	44	Minutes
Meridian	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	72°	Altitudes

Latitude 53° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 23	0 22	0 22	0 22	0 22	0 22	0 22	0 22	0 21	0 21	0 20	4
8	1 35	1 34	1 33	1 31	1 30	1 29	1 28	1 26	1 26	1 24	1 23	1 23	8
12	3 34	3 31	3 28	3 25	3 23	3 20	3 27	3 14	3 13	3 10	3 08	3 06	12
16	6 18	6 13	6 08	6 03	6 01	5 56	5 51	5 46	5 43	5 38	5 36	5 30	16
20	9 52	9 44	9 36	9 28	9 24	9 16	9 08	9 00	8 56	8 48	8 44	8 36	20
24	14 12	14 01	13 49	13 38	13 32	13 21	13 09	12 58	12 52	12 41	12 35	12 23	24
28	19 21	19 05	18 49	18 34	18 26	18 10	17 54	17 38	17 30	17 15	17 07	16 52	28
32	25 16	24 55	24 35	24 14	24 04	23 43	23 23	23 02	22 52	22 31	22 21	22 01	32
36	31 58	31 32	31 06	30 40	30 27	30 02	29 36	29 10	28 57	28 31	28 18	27 52	36
40	39 28	38 56	38 24	37 52	37 36	37 04	36 32	36 00	35 44	35 12	34 56	34 24	40
44	47 45	47 06	46 27	45 49	45 29	44 51	44 13	43 34	43 14	42 36	42 16	41 37	44
48	56 50	56 04	55 18	54 32	54 09	53 22	52 36	51 50	51 27	50 41	50 18	49 32	48
52	66 42	65 48	64 54	64 00	63 33	62 38	61 44	60 50	60 23	59 29	59 02	58 08	52
56	77 21	76 18	75 15	74 13	73 41	72 39	71 37	70 34	70 02	69 00	68 28	67 25	56
60	88 48	87 36	86 24	85 12	84 36	83 24	82 12	81 00	80 24	79 12	78 36	77 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.48	1.46	1.44	1.425	1.41	1.39	1.37	1.35	1.34	1.32	1.31	1.29	$\triangle_1 h$
Log.	0.170 26	0.164 35	0.158 36	0.153 81	0.149 22	0.143 01	0.136 72	0.130 33	0.127 10	0.120 57	0.117 27	0.110 59	Log.
Limit	55	55	56	56	57	58	58	59	60	61	62	62	Minutes
Meridian	37°	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	Altitudes

3

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 20	0 20	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 18	0 18	4
8	1 22	1 21	1 20	1 19	1 18	1 17	1 16	1 15	1 14	1 13	1 12	1 11	8
12	3 05	3 02	3 00	2 57	2 56	2 53	2 51	2 48	2 47	2 45	2 42	2 41	12
16	5 27	5 22	5 20	5 15	5 12	5 07	5 05	5 00	4 57	4 55	4 50	4 47	16
20	8 32	8 24	8 20	8 12	8 08	8 00	7 56	7 48	7 44	7 40	7 32	7 28	20
24	12 17	12 06	12 00	11 48	11 43	11 31	11 26	11 14	11 09	11 03	10 51	10 46	24
28	16 44	16 28	16 20	16 05	15 57	15 41	15 33	15 17	15 09	15 01	14 46	14 38	28
32	21 51	21 30	21 20	21 00	20 49	20 29	20 18	19 58	19 47	19 37	19 17	19 06	32
36	27 39	27 13	27 00	26 34	26 21	25 55	25 43	25 17	25 04	24 51	24 25	24 12	36
40	34 08	33 36	33 20	32 48	32 32	32 00	31 44	31 12	30 56	30 40	30 08	29 52	40
44	41 18	40 39	40 20	39 41	39 22	38 43	38 24	37 46	37 26	37 07	36 28	36 09	44
48	49 09	48 23	48 00	47 14	46 51	46 05	45 41	44 55	44 32	44 09	43 23	43 00	48
52	57 41	56 47	56 20	55 26	54 59	54 05	53 37	52 43	52 16	51 49	50 55	50 28	52
56	66 54	65 51	65 20	64 17	63 46	62 43	62 12	61 10	60 38	60 07	59 04	58 33	56
60	76 48	75 36	75 00	73 48	73 12	72 00	71 24	70 12	69 36	69 00	67 48	67 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.28	1.26	1.245	1.23	1.22	1.205	1.19	1.175	1.16	1.145	1.13	1.12	$\triangle_1 h$
Log.	0.107 21	0.100 37	0.095 17	0.089 91	0.086 36	0.080 99	0.075 55	0.070 04	0.064 46	0.058 81	0.053 08	0.049 22	Log.
Limit	63	64	65	65	65	65	66	67	68	69	70	71	Minutes
Meridian	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	Altitudes

Latitude 53° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 17	0 17	0 17	0 17	0 17	0 17	0 16	0 16	...	...	...	4
8	1 11	1 10	1 09	1 08	1 07	1 07	1 05	1 05	1 04	...	...	...	8
12	2 39	2 37	2 34	2 33	2 31	2 30	2 28	2 25	2 24	...	...	...	12
16	4 45	4 39	4 34	4 31	4 29	4 26	4 24	4 19	4 16	...	...	...	16
20	7 24	7 16	7 08	7 04	7 00	6 56	6 52	6 44	6 40	...	...	...	20
24	10 40	10 28	10 16	10 11	10 05	9 59	9 53	9 42	9 36	...	...	...	24
28	14 30	14 15	13 59	13 51	13 43	13 35	13 28	13 12	13 04	...	...	...	28
32	18 56	18 36	18 16	18 05	17 55	17 45	17 35	17 14	17 04	...	...	...	32
36	23 59	23 33	23 07	22 54	22 41	22 28	22 15	21 49	21 36	...	...	...	36
40	29 36	29 04	28 32	28 16	28 00	27 47	27 28	26 56	26 40	...	...	...	40
44	35 49	35 10	34 32	34 12	33 53	33 33	33 14	32 35	32 16	...	...	...	44
48	42 37	41 51	41 05	40 42	40 19	39 56	39 33	38 47	38 24	...	...	...	48
52	50 01	49 07	48 13	47 46	47 19	46 52	46 25	45 31	45 04	...	...	...	52
56	58 01	56 58	55 56	55 24	54 53	54 21	53 50	52 47	52 16	...	...	...	56
60	66 36	65 24	64 12	63 36	63 00	62 24	61 48	60 36	60 00	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.11	1.09	1.07	1.06	1.05	1.04	1.03	1.01	1.00	0.99	...	...	$\triangle_1 h$
Log.	0.045 32	0.037 43	0.029 38	0.025 31	0.021 19	0.017 03	0.012 84	0.004 32	0.00 ...	9.995 64	... ...	... ...	Log.
Limit	72	72	73	74	75	76	77	78	79				Minutes
Meridian	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	0 14	0 14	0 14	0 14	0 14	0 13	4
8	...	...	...	...	...	...	0 56	0 56	0 55	0 54	0 53	0 52	8
12	...	...	...	...	...	...	2 07	2 05	2 04	2 01	1 59	1 58	12
16	...	...	...	...	...	...	3 45	3 43	3 40	3 35	3 33	3 30	16
20	...	...	...	...	...	...	5 52	5 48	5 44	5 36	5 32	5 28	20
24	...	...	...	...	...	...	8 27	8 21	8 16	8 04	7 58	7 53	24
28	...	...	...	...	...	...	11 30	11 22	11 14	10 58	10 51	10 43	28
32	...	...	...	...	...	...	15 01	14 51	14 40	14 20	14 10	13 59	32
36	...	...	...	...	...	...	19 01	18 48	18 35	18 09	17 56	17 43	36
40	...	...	...	...	...	...	23 28	23 12	22 56	22 24	22 08	21 52	40
44	...	...	...	...	...	...	28 24	28 05	27 45	27 06	26 47	26 28	44
48	...	...	...	...	...	...	33 47	33 24	33 01	32 15	31 52	31 29	48
52	...	...	...	...	...	...	39 39	39 12	38 45	37 51	37 24	36 57	52
56	...	...	...	...	...	...	46 00	45 20	44 57	43 54	43 23	42 52	56
60	...	...	...	...	...	...	52 48	52 12	51 36	50 24	49 48	49 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	0.88	0.87	0.86	0.84	0.83	0.82	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	9.944 48	9.939 52	9.924 50	9.924 28	9.919 08	9.913 81	Log.
Limit							76	76	76	76	76	76	Minutes
Meridian	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	Altitudes

Declinations. — Inferior Meridian.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 13	0 12	0 12	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 11	0 11	4
8	0 52	0 51	0 50	0 49	0 48	0 48	0 46	0 46	0 45	0 44	0 44	0 42	8
12	1 56	1 54	1 53	1 50	1 48	1 47	1 44	1 42	1 41	1 39	1 36	1 35	12
16	3 28	3 22	3 19	3 14	3 12	3 09	3 04	3 02	2 59	2 57	2 52	2 49	16
20	5 24	5 16	5 12	5 04	5 00	4 56	4 48	4 44	4 40	4 46	4 28	4 24	20
24	7 47	7 35	7 29	7 18	7 12	7 06	6 55	6 49	6 43	6 38	6 26	6 21	24
28	10 35	10 20	10 12	9 56	9 48	9 40	9 25	9 17	9 09	9 01	8 45	8 37	28
32	13 49	13 29	13 19	12 58	12 48	12 38	12 17	12 07	11 57	11 46	11 26	11 15	32
36	17 30	17 04	16 51	16 25	16 12	15 59	15 33	15 20	15 07	14 55	14 29	14 16	36
40	21 36	21 04	20 48	20 16	20 00	19 44	19 12	18 56	18 40	18 24	17 52	17 36	40
44	26 08	25 29	25 10	24 31	24 12	23 52	23 14	22 54	22 35	22 16	21 38	21 18	44
48	31 06	30 18	29 55	29 09	28 46	28 23	27 37	27 14	26 51	26 29	25 43	25 20	48
52	36 30	35 36	35 09	34 15	33 48	33 21	32 27	32 00	31 33	31 05	30 11	29 44	52
56	42 20	41 17	40 46	39 44	39 12	38 40	37 38	37 06	36 35	36 04	35 02	34 30	56
60	48 36	47 24	46 48	45 36	45 00	44 24	43 12	42 36	42 00	41 24	40 12	39 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.81	0.79	0.78	0.76	0.75	0.74	0.72	0.71	0.70	0.69	0.67	0.66	$\triangle_1$h
Log.	9.908 49	9.897 63	9.892 09	9.880 81	9.875 06	9.869 23	9.857 33	9.851 26	9.845 10	9.838 85	9.826 07	9.819 54	Log.
Limit	76	76	76	76	76	76	76	76	76	76	76	76	Minutes
Meridian	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	Altitudes

Declinations. — Inferior Meridian.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 10	0 09	0 09	0 09	0 09	0 09	0 09	0 08	0 08	0 07	4
8	0 41	0 41	0 40	0 38	0 37	0 37	0 36	0 35	0 33	0 32	0 31	0 30	8
12	1 32	1 30	1 27	1 25	1 24	1 21	1 19	1 18	1 15	1 12	1 09	1 07	12
16	2 44	2 42	2 37	2 31	2 28	2 23	2 21	2 18	2 13	2 08	2 03	1 57	16
20	4 16	4 12	4 04	3 56	3 52	3 44	3 40	3 36	3 28	3 20	3 12	3 04	20
24	6 09	6 03	5 52	5 40	5 32	5 23	5 17	5 11	5 00	4 48	4 36	4 25	24
28	8 21	8 14	7 58	7 43	7 35	7 19	7 11	7 03	6 48	6 32	6 16	6 01	28
32	10 55	10 45	10 24	10 04	9 54	9 33	9 23	9 13	8 52	8 32	8 12	7 51	32
36	13 50	13 37	13 11	12 45	12 32	12 06	11 23	11 40	11 14	10 48	10 22	9 56	36
40	17 04	16 48	16 16	15 44	15 28	14 56	14 40	14 24	13 52	13 20	12 48	12 16	40
44	20 39	20 20	19 41	19 02	18 43	18 04	17 45	17 25	16 47	16 08	15 29	14 51	44
48	24 34	24 11	23 25	22 39	22 16	21 30	21 07	20 44	19 58	19 12	18 26	17 40	48
52	28 50	28 23	27 29	26 35	26 08	25 14	24 47	24 20	23 26	22 32	21 38	20 44	52
56	33 27	32 56	31 53	30 50	30 19	29 16	28 45	28 13	27 11	26 08	25 05	24 02	56
60	38 24	37 48	36 36	35 24	34 48	33 36	33 00	32 24	31 12	30 00	28 48	27 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.64	0.63	0.61	0.59	0.58	0.56	0.55	0.54	0.52	0.50	0.48	0.46	$\triangle_1$h
Log.	9.806 18	9.799 34	9.785 33	9.770 85	9.763 43	9.748 19	9.740 36	9.732 39	9.716 00	9.698 97	9.681 24	9.662 76	Log.
Limit	76	76	76	76	76	76	77	78	79	80	81	81	Minutes
Meridian	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	Altitudes

Latitude 54° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 23	0 23	0 24	0 24	0 25	0 25	0 25	0 26	0 27	0 27	4
8	1 32	1 33	1 34	1 35	1 36	1 37	1 39	1 41	1 42	1 42	1 45	1 46	8
12	3 24	3 28	3 31	3 34	3 36	3 39	3 42	3 46	3 49	3 51	3 56	3 59	12
16	6 06	6 08	6 13	6 18	6 24	6 29	6 34	6 42	6 47	6 53	7 00	7 05	16
20	9 32	9 36	9 44	9 52	10 00	10 08	10 16	10 28	10 36	10 44	10 56	11 04	20
24	13 43	13 49	14 01	14 12	14 24	14 36	14 47	15 04	15 16	15 28	15 45	15 57	24
28	18 42	18 49	19 05	19 21	19 36	19 52	20 07	20 31	20 47	21 02	21 25	21 41	28
32	24 25	24 35	24 55	25 16	25 36	25 56	26 17	26 48	27 08	27 28	27 59	28 19	32
36	30 53	31 06	31 32	31 58	32 24	32 50	33 16	33 55	34 21	34 47	35 26	35 52	36
40	38 08	38 24	38 56	39 28	40 00	40 32	41 04	41 52	42 24	42 56	43 44	44 16	40
44	46 08	46 27	47 06	47 45	48 24	49 03	49 41	50 40	51 18	51 57	52 55	53 34	44
48	54 55	55 18	56 04	56 50	57 36	58 22	59 08	60 17	61 03	61 49	62 58	63 44	48
52	64 27	64 54	65 48	66 42	67 36	68 30	69 24	70 45	71 39	72 33	73 54	74 48	52
56	74 44	75 15	76 18	77 21	78 24	79 27	80 29	82 04	83 06	84 09	85 43	86 46	56
60	85 48	86 24	87 36	88 48	90 00	91 12	92 24	94 12	95 24	96 36	98 24	99 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.43	1.44	1.46	1.48	1.50	1.52	1.54	1.57	1.59	1.61	1.64	1.66	$\Delta_1 h$
Log.	0.155 34	0.158 36	0.164 35	0.170 26	0.176 09	0.181 84	0.187 52	0.195 90	0.201 40	0.206 83	0.214 84	0.220 11	Log.
Limit	56	56	55	54	54	54	53	52	52	51	51	50	Minutes
Meridian	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 28	0 28	0 29	0 29	0 30	0 30	0 31	0 31	0 32	0 33	4
8	1 48	1 50	1 52	1 54	1 55	1 57	2 00	2 01	2 04	2 06	2 09	2 12	8
12	4 03	4 06	4 11	4 16	4 19	4 23	4 29	4 34	4 40	4 46	4 51	4 57	12
16	7 13	7 18	7 25	7 33	7 41	7 49	7 59	8 06	8 16	8 26	8 37	8 47	16
20	11 16	11 24	11 36	11 48	12 00	12 12	12 28	12 40	12 56	13 12	13 28	13 44	20
24	16 14	16 25	16 42	16 59	17 17	17 34	17 57	18 14	18 37	19 00	19 24	19 47	24
28	22 05	22 21	22 44	23 08	23 31	23 55	24 26	24 50	25 21	25 53	26 24	26 55	28
32	28 50	29 11	29 42	30 13	30 43	31 13	31 55	32 26	33 07	33 48	34 28	35 09	32
36	36 31	36 56	37 35	38 14	38 53	39 32	40 24	41 02	41 54	42 46	43 38	44 30	36
40	45 04	45 36	46 24	47 12	48 00	48 48	49 52	50 40	51 44	52 48	53 52	54 56	40
44	54 32	55 10	56 08	57 07	58 05	59 03	60 21	61 18	62 35	63 53	65 11	66 28	44
48	64 53	65 38	66 47	67 56	69 07	70 16	71 48	72 58	74 30	76 02	77 34	79 06	48
52	76 09	77 04	78 25	79 46	81 07	82 28	84 16	85 38	87 26	89 14	91 02	92 50	52
56	88 20	89 22	90 56	92 31	94 05	95 39	97 45	99 18	101 23	103 29	105 35	106 06	56
60	101 24	102 36	104 24	106 12	108 00	109 48	112 12	114 00	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.69	1.71	1.74	1.77	1.80	1.83	1.87	1.90	1.94	1.98	2.02	2.06	$\Delta_1 h$
Log.	0.227 89	0.233 00	0.240 55	0.247 97	0.255 27	0.262 45	0.271 84	0.278 75	0.287 80	0.296 67	0.305 35	0.313 87	Log.
Limit	49	49	48	48	47	46	46	45	45	44	43	42	Minutes
Meridian	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 34	0 34	0 35	0 36	0 38	0 39	0 40	0 40	0 43	0 43	0 45	0 47	4
8	2 14	2 18	2 22	2 26	2 28	2 33	2 37	2 42	2 48	2 53	2 59	3 06	8
12	5 05	5 10	5 18	5 27	5 35	5 45	5 54	6 06	6 17	6 30	6 43	6 59	12
16	8 59	9 12	9 26	9 41	9 52	10 11	10 30	10 48	11 07	11 32	11 56	12 22	16
20	14 04	14 23	14 44	15 08	15 28	15 56	16 24	16 52	17 24	18 00	18 39	19 20	20
24	20 15	20 45	21 13	21 48	22 16	22 56	23 38	24 17	25 04	25 56	26 53	27 50	24
28	27 33	28 13	28 53	29 40	30 18	31 14	32 08	33 04	34 07	35 16	36 35	37 54	28
32	36 01	36 51	37 43	38 44	39 36	40 48	44 58	43 11	44 32	46 05	47 47	49 30	32
36	45 35	46 40	47 44	49 02	50 07	51 37	53 09	54 39	56 23	58 19	60 29	62 38	36
40	56 16	57 36	58 56	60 32	61 52	63 44	65 36	67 28	69 36	72 00	74 40	77 20	40
44	68 05	69 42	71 18	73 15	74 52	77 07	79 22	81 38	...	...	...	...	44
48	81 01	82 56	84 52	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.11	2.16	2.21	2.27	2.32	2.39	2.46	2.53	2.61	2.70	2.80	2.90	$\triangle_1 h$
Log.	0.324 28	0.334 45	0.344 39	0.356 03	0.365 49	0.378 40	0.390 94	0.403 12	0.416 64	0.431 36	0.447 16	0.462 40	Log.
Limit	41	40	39	38	37	37	36	35	34	33	32	32	Minutes
Meridian	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 48	0 50	0 53	0 56	0 58	1 02	1 06	1 10	1 17	1 24	1 32	1 43	4
8	3 14	3 22	3 31	3 42	3 54	4 07	4 23	4 43	5 06	5 34	6 08	6 53	8
12	7 15	7 34	7 55	8 19	8 46	9 17	9 53	10 36	11 28	12 32	13 50	15 31	12
16	12 54	13 27	14 04	14 48	15 35	16 31	17 35	18 51	20 22	22 16	24 34	27 34	16
20	20 09	21 00	21 59	23 07	24 20	25 47	27 28	29 27	31 52	35 48	38 24	43 04	20
24	29 00	30 14	31 39	33 18	35 03	37 09	39 34	42 26	45 53	50 07	55 18	...	24
28	39 28	41 08	43 07	45 21	47 41	50 34	53 50	57 46	...	...	...	...	28
32	51 31	53 45	56 19	59 14	62 17	66 03	...	...	...	...	...	...	32
36	65 14	68 03	71 17	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.02	3.15	3.30	3.47	3.65	3.87	4.12	4.42	4.78	5.22	5.76	6.46	$\triangle_1 h$
Log.	0.480 01	0.498 31	0.518 51	0.540 33	0.562 29	0.587 71	0.614 90	0.645 42	0.679 43	0.717 67	0.760 42	0.810 23	Log.
Limit	31	30	29	28	27	26	24	23	21	20	19	18	Minutes
Meridian	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	Altitudes

Latitude 54° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 58	2 20	...	...	...	...	...	...	...	...	...	1 49	4
8	7 52	9 16	...	...	...	...	...	...	...	...	...	7 16	8
12	17 44	20 51	...	...	...	...	...	...	...	...	...	16 22	12
16	31 32	37 05	...	...	...	...	...	...	...	...	...	29 06	16
20	49 16	...	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	7.39	8.69	...	...	...	...	...	...	...	...	...	6.82	$\Delta_1 h$
Log.	0.868 64	0.939 02	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.833 78	Log.
Limit	16	13	10	8	6	3	0	3	5	8	11	14	Minutes
Meridian	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 28	1 14	1 02	0 53	0 47	0 41	0 36	0 32	0 28	0 26	0 23	0 20	4
8	5 53	4 54	4 09	3 34	3 06	2 44	2 25	2 08	1 55	1 42	1 32	1 21	8
12	13 15	11 01	9 19	8 00	6 59	6 09	5 26	4 48	4 18	3 50	3 24	3 02	12
16	23 33	19 35	16 35	14 18	12 25	10 55	9 38	8 32	7 38	6 50	6 06	5 22	16
20	36 48	30 36	25 56	22 20	19 24	17 04	15 04	13 20	11 56	10 40	9 32	8 24	20
24	...	44 04	37 21	32 10	27 56	24 35	21 42	19 12	17 11	15 22	13 43	12 06	24
28	...	...	...	43 46	38 02	33 27	29 32	26 08	23 24	20 54	18 42	16 28	28
32	...	...	...	...	...	43 41	38 34	34 08	30 33	27 18	24 25	21 30	32
36	...	...	...	...	...	...	48 49	43 12	38 40	34 34	30 53	27 13	36
40	...	...	...	...	...	...	...	53 20	47 44	42 40	38 08	33 36	40
44	...	...	...	...	...	...	...	...	57 45	51 38	46 08	40 39	44
48	...	...	...	...	...	...	...	...	...	61 26	54 55	48 23	48
52	...	...	...	...	...	...	...	...	...	...	...	56 47	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	5.52	4.59	3.89	3.35	2.91	2.56	2.26	2.00	1.79	1.60	1.43	1.26	$\Delta_1 h$
Log.	0.741 94	0.661 81	0.589 95	0.525 04	0.463 89	0.408 24	0.354 11	0.301 03	0.252 85	0.204 12	0.155 34	0.100 37	Log.
Limit	16	19	21	23	25	28	31	33	36	39	41	43	Minutes
Meridian	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	73°	Altitudes

Latitude 54° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 22	0 22	0 22	0 21	0 21	0 20	0 20	0 20	0 20	4
8	1 32	1 30	1 29	1 28	1 27	1 26	1 25	1 23	1 23	1 22	1 21	1 20	8
12	3 24	3 23	3 20	3 17	3 16	3 13	3 11	3 08	3 06	3 05	3 02	3 00	12
16	6 06	6 01	5 56	5 51	5 48	5 43	5 41	5 36	5 30	5 27	5 22	5 20	16
20	9 32	9 24	9 16	9 08	9 04	8 56	8 52	8 44	8 36	8 32	8 24	8 20	20
24	13 43	13 32	13 21	13 09	13 04	12 52	12 46	12 35	12 23	12 17	12 06	12 00	24
28	18 42	18 26	18 10	17 54	17 46	17 30	17 23	17 07	16 52	16 44	16 28	16 20	28
32	24 25	24 04	23 43	23 23	23 12	22 52	22 42	22 21	22 01	21 51	21 30	21 20	32
36	30 53	30 27	30 02	29 36	29 23	28 57	28 44	28 18	27 52	27 39	27 13	27 00	36
40	38 08	37 36	37 04	36 32	36 16	35 44	35 28	34 56	34 24	34 08	33 36	33 20	40
44	46 08	45 29	44 51	44 13	43 53	43 14	42 55	42 16	41 37	41 18	40 39	40 20	44
48	54 55	54 09	53 22	52 36	52 13	51 27	51 04	50 18	49 32	49 09	48 23	48 00	48
52	64 27	63 33	62 38	61 44	61 17	60 23	59 56	59 02	58 08	57 41	56 47	56 20	52
56	74 44	73 41	72 39	71 37	71 05	70 02	69 31	68 28	67 25	66 54	65 51	65 20	56
60	85 48	84 36	83 24	82 12	81 36	80 24	79 48	78 36	77 24	76 48	75 36	75 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.43	1.41	1.39	1.37	1.36	1.34	1.33	1.31	1.29	1.28	1.26	1.25	$\triangle_1 h$
Log.	0.155 34	0.149 22	0.143 01	0.136 72	0.133 54	0.127 10	0.123 85	0.117 27	0.110 59	0.107 21	0.100 37	0.096 91	Log.
Limit	56	56	57	58	59	60	60	61	62	63	63	63	Minutes
Meridian	36°	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 18	0 18	0 18	0 17	4
8	1 20	1 18	1 17	1 16	1 15	1 15	1 13	1 13	1 12	1 11	1 10	1 10	8
12	2 59	2 56	2 54	2 51	2 50	2 48	2 45	2 44	2 42	2 41	2 38	2 37	12
16	5 17	5 12	5 10	5 05	5 02	5 00	4 55	4 52	4 50	4 47	4 42	4 39	16
20	8 16	8 08	8 04	7 56	7 52	7 48	7 40	7 36	7 32	7 28	7 20	7 16	20
24	11 54	11 43	11 37	11 26	11 20	11 14	11 03	10 57	10 51	10 46	10 34	10 28	24
28	16 12	15 57	15 49	15 33	15 25	15 17	15 01	14 53	14 46	14 38	14 22	14 15	28
32	21 10	20 49	20 39	20 18	20 08	19 58	19 37	19 27	19 17	19 06	18 46	18 36	32
36	26 47	26 21	26 08	25 43	25 30	25 17	24 51	24 38	24 25	24 12	23 46	23 33	36
40	33 04	32 32	32 16	31 44	31 28	31 12	30 40	30 24	30 08	29 52	29 20	29 04	40
44	40 00	39 22	39 02	38 24	38 05	37 46	37 07	36 47	36 28	36 09	35 30	35 10	44
48	47 37	46 51	46 28	45 41	45 18	44 45	44 09	43 46	43 23	43 00	42 14	41 51	48
52	55 53	54 59	54 32	53 37	53 10	52 43	51 49	51 22	50 55	50 28	49 34	49 07	52
56	64 48	63 46	63 14	62 12	61 41	61 10	60 07	59 35	59 04	58 33	57 30	56 58	56
60	74 24	73 12	72 36	71 24	70 48	70 12	69 00	68 24	67 48	67 12	66 00	65 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.24	1.22	1.21	1.19	1.18	1.17	1.15	1.14	1.13	1.12	1.10	1.09	$\triangle_1 h$
Log.	0.093 42	0.086 36	0.082 79	0.075 55	0.071 88	0.068 19	0.060 70	0.056 90	0.053 08	0.049 22	0.041 39	0.037 43	Log.
Limit	64	65	66	66	66	66	67	68	69	69	71	72	Minutes
Meridian	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	Altitudes

Latitude 54° Declination Contrary Name.

DECLINATIONS.

06

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 17	0 17	0 16	0 16	0 16	0 15	0 15	...	...	...	4
8	1 09	1 08	0 07	0 05	1 05	1 05	1 04	1 03	1 02	...	...	...	8
12	2 35	2 33	2 30	2 28	2 27	2 26	2 24	2 23	2 22	...	...	...	12
16	4 36	4 31	4 26	4 24	4 22	4 20	4 16	4 13	4 10	...	...	...	16
20	7 12	7 04	6 56	6 52	6 50	6 48	6 40	6 36	6 32	...	...	...	20
24	10 22	10 11	9 59	9 53	9 50	9 48	9 36	9 30	9 24	...	...	...	24
28	14 07	13 51	13 35	13 28	13 23	13 18	13 04	12 57	12 49	...	...	...	28
32	18 26	18 05	17 45	17 35	17 30	17 24	17 04	16 54	16 44	...	...	...	32
36	23 20	22 54	22 28	22 15	22 07	22 00	21 36	21 33	21 10	...	...	...	36
40	28 48	28 16	27 44	27 28	27 20	27 12	26 40	26 24	26 08	...	...	...	40
44	34 51	34 12	33 33	33 14	33 04	32 55	32 16	31 56	31 37	...	...	...	44
48	41 28	40 42	39 56	39 33	39 22	39 10	38 24	38 01	37 38	...	...	...	48
52	48 40	47 46	46 52	46 25	46 12	45 58	45 04	44 37	44 10	...	...	...	52
56	56 27	55 24	54 21	53 50	53 34	53 19	52 16	51 44	51 13	...	...	...	56
60	64 48	63 36	62 24	61 48	61 30	61 12	60 00	59 24	58 48	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.08	1.06	1.04	1.03	1.02	1.01	1.00	0.99	0.98	...	...	...	$\triangle_1$h
Log.	0.033 42	0.025 31	0.017 03	0.012 84	0.008 60	0.004 32	0.00 ...	9.995 64	9.991 23	... ...	... ...	... ...	Log.
Limit	73	74	75	76	77	78	79	80	81				Minutes
Meridian	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	0 14	0 14	0 14	0 14	0 14	0 14	0 13	0 13	4
8	...	...	...	...	0 57	0 56	0 55	0 54	0 54	0 53	0 52	0 51	8
12	...	...	...	...	2 08	2 07	2 04	2 02	2 01	1 59	1 56	1 55	12
16	...	...	...	...	3 48	3 45	3 40	3 38	3 35	3 33	3 28	3 25	16
20	...	...	...	...	5 56	5 52	5 44	5 40	5 36	5 32	5 24	5 20	20
24	...	...	...	...	8 33	8 27	8 16	8 10	8 04	7 58	7 47	7 41	24
28	...	...	...	...	11 38	11 30	11 14	11 06	10 58	10 51	10 35	10 27	28
32	...	...	...	...	15 11	15 01	14 40	14 30	14 20	14 10	13 49	13 39	32
36	...	...	...	...	19 14	19 01	18 35	18 22	18 09	17 56	17 30	17 17	36
40	...	...	...	...	23 44	23 28	22 56	22 40	22 24	22 08	21 36	21 20	40
44	...	...	...	...	28 43	28 24	27 45	27 26	27 06	26 47	26 08	25 49	44
48	...	...	...	...	34 10	33 47	33 01	32 38	32 15	31 52	31 06	30 43	48
52	...	...	...	...	40 06	39 39	38 45	38 18	37 51	37 24	36 30	36 03	52
56	...	...	...	...	46 31	46 00	44 57	44 26	43 54	43 23	42 20	41 49	56
60	...	...	...	...	53 24	52 48	51 36	51 00	50 24	49 48	48 36	48 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	0.89	0.88	0.86	0.85	0.84	0.83	0.81	0.80	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	9.949 39	9.944 48	9.934 50	9.929 42	9.924 28	9.919 08	9.908 49	9.903 09	Log.
Limit					79	79	79	79	79	79	79	79	Minutes
Meridian	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Altitudes

Latitude 54° Declination Contrary Name.

Declinations. — Inferior Meridian.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 11	0 11	0 11	4
8	0 51	0 50	0 49	0 48	0 48	0 46	0 46	0 44	0 44	0 42	0 42	0 41	8
12	1 54	1 53	1 50	1 48	1 47	1 44	1 42	1 39	1 38	1 36	1 35	1 32	12
16	3 22	3 19	3 14	3 12	3 09	3 04	3 02	2 57	2 54	2 52	2 49	2 44	16
20	5 16	5 12	5 04	5 00	4 56	4 48	4 44	4 36	4 32	4 28	4 24	4 16	20
24	7 35	7 29	7 18	7 12	7 06	6 55	6 49	6 38	6 32	6 26	6 21	6 09	24
28	10 20	10 12	9 56	9 48	9 40	9 25	9 17	9 01	8 53	8 45	8 37	8 21	28
32	13 29	13 19	12 58	12 48	12 38	12 17	12 07	11 46	11 36	11 26	11 15	10 55	32
36	17 04	16 51	16 25	16 12	15 59	15 33	15 20	14 55	14 42	14 29	14 16	13 50	36
40	21 04	20 48	20 16	20 00	19 44	19 12	18 56	18 24	18 08	17 52	17 36	17 04	40
44	25 29	25 10	24 31	24 12	23 52	23 14	22 54	22 16	21 57	21 38	21 18	20 39	44
48	30 18	29 55	29 09	28 46	28 23	27 37	27 14	26 29	26 08	25 43	25 20	24 34	48
52	35 36	35 09	34 15	33 48	33 21	32 27	32 00	31 05	30 38	30 11	29 44	28 50	52
56	41 17	40 46	39 44	39 12	38 40	37 38	37 06	36 04	35 33	35 02	34 30	33 27	56
60	47 24	46 48	45 36	45 00	44 24	43 12	42 36	41 24	40 48	40 12	39 36	38 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.79	0.78	0.76	0.75	0.74	0.72	0.71	0.69	0.68	0.67	0.66	0.64	$\triangle_1$h
Log.	9.897 63	9.892 09	9.880 81	9.875 06	9.869 23	9.857 33	9.851 26	9.838 85	9.832 51	9.826 07	9.819 54	9.806 18	Log.
Limit	79	79	79	79	79	79	79	79	79	79	79	79	Minutes
Meridian	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Altitudes

Declinations. — Inferior Meridian.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 10	0 10	0 09	0 09	0 09	0 09	0 09	0 08	0 08	0 07	0 07	4
8	0 41	0 39	0 38	0 38	0 37	0 36	0 35	0 35	0 32	0 32	0 31	0 29	8
12	1 30	1 29	1 26	1 24	1 22	1 19	1 18	1 16	1 13	1 11	1 08	1 05	12
16	2 42	2 39	2 34	2 28	2 26	2 21	2 18	2 16	2 11	2 05	2 00	1 55	16
20	4 12	4 08	4 00	3 52	3 48	3 40	3 36	3 32	3 24	3 16	3 08	3 00	20
24	6 03	5 58	5 46	5 32	5 28	5 17	5 11	5 05	4 54	4 42	4 30	4 19	24
28	8 14	8 06	7 50	7 35	7 27	7 11	7 03	6 56	6 40	6 25	6 09	5 53	28
32	10 45	10 34	10 14	9 54	9 44	9 23	9 13	9 03	8 42	8 22	8 02	7 41	32
36	13 37	13 24	12 58	12 32	12 19	11 53	11 40	11 27	11 01	10 35	10 09	9 43	36
40	16 48	16 32	16 00	15 28	15 12	14 40	14 24	14 08	13 36	13 04	12 32	12 00	40
44	20 20	20 01	19 22	18 43	18 24	17 45	17 25	17 06	16 27	15 48	15 10	14 31	44
48	24 11	23 48	23 02	22 16	21 53	21 07	20 44	20 21	19 35	18 49	18 03	17 17	48
52	28 23	27 56	27 02	26 08	25 41	24 47	24 20	23 53	22 59	22 05	21 11	20 17	52
56	35 26	32 25	31 22	30 19	29 48	28 45	28 13	27 42	26 39	25 36	24 34	23 31	56
60	37 48	37 12	36 00	34 48	34 12	33 00	32 24	31 48	30 36	29 24	28 12	27 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.63	0.62	0.60	0.58	0.57	0.55	0.54	0.53	0.51	0.49	0.47	0.45	$\triangle_1$h
Log.	9.799 34	9.792 39	9.778 15	9.763 43	9.755 87	9.740 36	9.732 39	9.724 28	9.707 57	9.690 20	9.672 10	9.653 21	Log.
Limit	79	79	79	79	79	79	79	79	79	80	81	81	Minutes
Meridian	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Altitudes

Latitude 55° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 22	0 23	0 23	0 23	0 24	0 24	0 25	0 25	0 25	4
8	1 28	1 29	1 30	1 32	1 33	1 34	1 35	1 36	1 37	1 39	1 41	1 42	8
12	3 17	3 20	3 23	3 24	3 29	3 31	3 34	3 36	3 39	3 43	3 46	3 49	12
16	5 51	5 56	6 01	6 06	6 11	6 13	6 18	6 24	6 29	6 37	6 42	6 47	16
20	9 08	9 16	9 24	9 32	9 40	9 44	9 52	10 00	10 08	10 20	10 28	10 36	20
24	13 09	13 21	13 32	13 43	13 55	14 01	14 12	14 24	14 36	14 53	15 04	15 16	24
28	17 54	18 10	18 26	18 42	18 57	19 05	19 21	19 36	19 52	20 15	20 31	20 47	28
32	23 23	23 43	24 04	24 25	24 45	24 55	25 16	25 36	25 56	26 27	26 48	27 08	32
36	29 36	30 02	30 27	30 53	31 19	31 32	31 58	32 24	32 50	33 29	33 55	34 21	36
40	36 32	37 04	37 36	38 08	38 40	38 56	39 28	40 00	40 32	41 20	41 52	42 24	40
44	44 13	44 51	45 29	46 08	46 47	47 06	47 45	48 24	49 03	50 01	50 40	51 18	44
48	52 36	53 22	54 09	54 55	55 41	56 04	56 50	57 36	58 22	59 31	60 17	61 03	48
52	61 44	62 38	63 33	64 27	65 21	65 48	66 42	67 36	68 30	69 51	70 45	71 39	52
56	71 37	72 39	73 41	74 44	75 37	76 18	77 21	78 24	79 27	81 01	82 04	83 06	56
60	82 12	83 24	84 36	85 48	87 00	87 36	88 48	90 00	91 12	93 00	94 12	95 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.37	1.39	1.41	1.43	1.45	1.46	1.48	1.50	1.52	1.55	1.57	1.59	$\triangle_1 h$
Log.	0.136 72	0.143 01	0.149 22	0.155 34	0.161 37	0.164 35	0.170 26	0.176 09	0.181 84	0.190 33	0.195 90	0.201 40	Log.
Limit	58	58	57	56	56	55	55	54	53	52	52	51	Minutes
Meridian	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 26	0 27	0 27	0 27	0 27	0 28	0 28	0 29	0 30	0 30	0 30	0 31	4
8	1 43	1 45	1 47	1 48	1 50	1 52	1 54	1 56	1 58	2 00	2 02	2 05	8
12	3 53	3 56	4 00	4 03	4 08	4 12	4 17	4 20	4 26	4 31	4 37	4 43	12
16	6 55	7 00	7 08	7 13	7 20	7 28	7 35	7 44	7 54	8 01	8 11	8 21	16
20	10 48	10 56	11 08	11 16	11 28	11 40	11 52	12 04	12 20	12 32	12 48	13 04	20
24	15 34	15 45	16 02	16 14	16 31	16 48	17 05	17 23	17 46	18 03	18 26	18 49	24
28	21 10	21 25	21 49	22 05	22 29	22 52	23 16	23 39	24 10	24 34	25 06	25 37	28
32	27 38	27 59	28 30	28 50	29 21	29 52	30 23	30 53	31 34	32 05	32 46	33 27	32
36	35 00	35 26	36 05	36 31	37 09	37 48	38 27	39 06	39 58	40 37	41 28	42 20	36
40	43 12	43 44	44 32	45 04	45 52	46 40	47 28	48 16	49 20	50 08	51 12	52 16	40
44	52 17	52 55	53 54	54 32	55 30	56 28	57 26	58 24	59 42	60 40	61 57	63 14	44
48	62 12	62 58	64 07	64 53	66 01	67 10	68 19	69 30	71 02	72 11	73 44	75 16	48
52	73 00	73 54	75 15	76 09	77 31	78 52	80 13	81 34	83 22	84 43	86 32	88 20	52
56	84 41	85 43	87 18	88 20	89 54	91 28	93 02	94 36	96 42	98 15	100 21	102 26	56
60	97 12	98 24	100 12	101 24	103 12	105 00	106 48	108 36	111 00	112 48	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.62	1.64	1.67	1.69	1.72	1.75	1.78	1.81	1.85	1.88	1.92	1.96	$\triangle_1 h$
Log.	0.209 52	0.214 84	0.222 72	0.227 89	0.235 53	0.243 04	0.250 42	0.257 68	0.267 17	0.274 16	0.283 30	0.292 26	Log.
Limit	50	50	49	49	48	47	47	46	46	45	44	43	Minutes
Meridian	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 32	0 32	0 33	0 34	0 35	0 36	0 37	0 38	0 39	0 40	0 42	0 43	4
8	2 08	2 10	2 14	2 17	2 20	2 25	2 28	2 32	2 36	2 41	2 47	2 53	8
12	4 48	4 53	5 01	5 08	5 15	5 24	5 32	5 41	5 51	6 03	6 15	6 29	12
16	8 32	8 39	8 55	9 08	9 21	9 36	9 52	10 07	10 24	10 45	11 06	11 31	16
20	13 20	13 32	13 56	14 16	14 36	15 00	15 24	15 48	16 15	16 48	17 20	18 00	20
24	19 12	19 29	20 04	20 33	21 02	21 36	22 11	22 46	23 24	24 11	24 58	25 55	24
28	26 08	26 31	27 19	27 57	28 37	29 24	30 11	30 58	31 51	32 56	33 58	35 17	28
32	34 08	34 39	35 40	36 31	37 22	38 24	39 25	40 26	41 39	42 59	44 22	46 05	32
36	43 12	43 51	45 09	46 14	47 19	48 36	49 54	51 12	52 42	54 26	56 10	58 19	36
40	53 20	54 08	55 44	57 04	58 24	60 00	61 36	63 12	65 04	67 12	69 20	72 00	40
44	64 32	65 30	67 26	69 03	70 40	72 36	74 32	76 39	...	...	...	...	44
48	76 48	77 57	80 15	82 10	84 05	...	...	...	...	...	...	...	48
52	90 08	91 29	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.00	2.03	2.09	2.14	2.19	2.25	2.31	2.37	2.44	2.52	2.60	2.70	$\triangle_1 h$
Log.	0.301 03	0.307 50	0.320 15	0.330 41	0.340 44	0.352 18	0.363 61	0.374 75	0.387 39	0.401 40	0.414 97	0.431 36	Log.
Limit	42	42	41	40	39	38	37	37	36	35	34	33	Minutes
Meridian	59°	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 45	0 47	0 49	0 51	0 53	0 56	0 59	1 03	1 08	1 14	1 20	1 28	4
8	2 58	3 06	3 14	3 24	3 33	3 45	3 58	4 14	4 32	4 54	5 20	5 53	8
12	6 42	6 59	7 17	7 39	8 00	8 25	8 56	9 30	10 12	11 01	12 00	13 15	12
16	11 54	12 25	12 58	13 36	14 13	14 58	15 52	16 54	18 08	19 35	21 20	23 33	16
20	18 35	19 24	20 15	21 12	22 12	23 23	24 48	26 24	28 20	30 35	33 20	36 48	20
24	26 45	27 56	29 09	30 32	31 58	33 42	35 43	38 00	40 47	44 04	48 00	53 00	24
28	36 28	38 02	39 43	41 34	43 30	45 52	48 37	51 45	55 32	...	...	...	28
32	47 37	49 40	51 53	54 16	56 50	59 54	63 29	...	...	...	...	...	32
36	60 16	62 51	65 40	68 42	...	...	...	...	...	...	...	...	36
40	74 24	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.79	2.91	3.04	3.18	3.33	3.51	3.72	3.96	4.25	4.59	5.00	5.52	$\triangle_1 h$
Log.	0.445 60	0.463 89	0.482 87	0.502 43	0.522 44	0.545 31	0.570 54	0.597 70	0.628 39	0.661 81	0.698 97	0.741 94	Log.
Limit	32	31	30	29	28	27	25	24	23	22	22	21	Minutes
Meridian	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	Altitudes

Latitude 55° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 32	1 54	2 13	...	...	...	...	...	...	...	...	...	4
8	6 33	7 32	8 52	...	...	...	...	...	...	...	...	...	8
12	14 50	17 00	19 57	...	...	...	...	...	...	...	...	...	12
16	26 22	30 10	35 28	...	...	...	...	...	...	...	...	...	16
20	41 12	47 08	...	...	...	...	...	...	...	...	...	...	20
24	...	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.18	7.07	8.31	...	...	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.790 99	0.849 42	0.863 92	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	18	16	13	11	9	7	3	0	3	7	9	11	Minutes
Meridian	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 43	1 24	1 09	0 58	0 50	0 44	0 38	0 34	0 30	0 27	0 23	0 21	4
8	6 53	5 36	4 38	3 56	3 22	2 55	2 33	2 15	2 00	1 47	1 36	1 23	8
12	15 31	12 36	10 24	8 48	7 35	6 35	5 46	5 06	4 31	4 00	3 35	3 08	12
16	27 34	22 23	18 30	15 41	13 29	11 42	10 15	9 02	8 01	7 08	6 21	5 36	16
20	...	35 00	28 56	24 29	21 03	18 16	16 01	14 08	12 32	11 08	9 56	8 44	20
24	...	...	...	35 14	30 21	26 19	23 03	20 21	18 03	16 02	14 18	12 35	24
28	...	...	...	...	...	...	31 22	27 41	24 34	21 49	19 29	17 07	28
32	...	...	...	...	...	...	...	36 11	32 05	28 30	25 26	22 21	32
36	...	...	...	...	...	...	...	...	40 37	36 05	32 11	28 18	36
40	...	...	...	...	...	...	...	...	...	44 32	39 44	34 56	40
44	...	...	...	...	...	...	...	...	...	53 54	48 04	42 16	44
48	...	...	...	...	...	...	...	...	...	...	57 13	50 18	48
52	...	...	...	...	...	...	...	...	...	...	...	59 02	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	6.46	5.25	4.34	3.67	3.16	2.74	2.40	2.12	1.88	1.67	1.49	1.31	$\triangle_1 h$
Log.	0.810 23	0.720 16	0.637 49	0.564 67	0.499 69	0.437 75	0.380 21	0.326 34	0.274 16	0.222 72	0.173 19	0.117 27	Log.
Limit	13	16	18	20	21	22	25	28	32	36	40	44	Minutes
Meridian	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	74°	Altitudes

Latitude 55° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 21	0 21	0 21	0 20	0 20	0 20	0 20	0 19	0 19	4
8	1 28	1 27	1 26	1 25	1 23	1 23	1 22	1 21	1 20	1 20	1 18	1 17	8
12	3 17	3 16	3 13	3 11	3 08	3 07	3 05	3 03	3 00	2 59	2 56	2 54	12
16	5 51	5 48	5 43	5 41	5 36	5 33	5 27	5 25	5 20	5 17	5 12	5 10	16
20	9 08	9 04	8 56	8 52	8 44	8 40	8 32	8 28	8 20	8 16	8 08	8 04	20
24	13 09	13 04	12 52	12 46	12 35	12 29	12 17	12 11	12 00	11 54	11 43	11 37	24
28	17 54	17 46	17 30	17 23	17 07	16 59	16 44	16 36	16 20	16 12	15 57	15 49	28
32	23 23	23 12	22 52	22 42	22 21	22 11	21 51	21 41	21 20	21 10	20 49	20 39	32
36	29 36	29 23	28 57	28 44	28 18	28 05	27 39	27 26	27 00	26 47	26 21	26 08	36
40	36 32	36 16	35 44	35 28	34 56	34 40	34 08	33 52	33 20	33 04	32 32	32 16	40
44	44 13	43 53	43 14	42 55	42 16	41 57	41 18	40 59	40 20	40 00	39 22	39 02	44
48	52 36	52 13	51 27	51 04	50 18	49 55	49 09	48 46	48 00	47 37	46 51	46 28	48
52	61 44	61 17	60 23	59 56	59 02	58 35	57 41	57 14	56 20	55 53	64 59	54 32	52
56	71 37	71 05	70 02	69 31	68 28	67 57	66 54	66 23	65 20	64 48	63 46	63 14	56
60	82 12	81 36	80 24	79 48	78 36	78 00	76 48	76 12	75 00	74 24	73 12	72 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.37	1.36	1.34	1.33	1.31	1.30	1.28	1.27	1.25	1.24	1.22	1.21	$\triangle_1$h
Log.	0.136 72	0.133 54	0.127 10	0.123 85	0.117 27	0.113 94	0.107 21	0.103 80	0.096 91	0.093 42	0.086 36	0.082 79	Log.
Limit	58	58	59	60	61	61	61	62	62	63	64	64	Minutes
Meridian	35°	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 19	0 19	0 18	0 18	0 18	0 18	0 17	0 17	0 17	4
8	1 17	1 15	1 15	1 14	1 13	1 12	1 11	1 11	1 10	1 09	1 08	1 08	8
12	2 53	2 50	2 48	2 47	2 44	2 42	2 41	2 39	2 38	2 36	2 34	2 33	12
16	5 07	5 02	5 00	4 57	4 52	4 50	4 47	4 45	4 42	4 36	4 34	4 31	16
20	8 00	7 52	7 48	7 44	7 36	7 32	7 28	7 24	7 20	7 12	7 08	7 04	20
24	11 31	11 20	11 14	11 09	10 57	10 51	10 46	10 40	10 34	10 22	10 16	10 11	24
28	15 41	15 25	15 17	15 09	14 53	14 46	14 38	14 30	14 22	14 07	13 59	13 51	28
32	20 29	20 08	19 58	19 47	19 27	19 17	19 06	18 56	18 46	18 26	18 16	18 05	32
36	25 55	25 30	25 17	25 04	24 38	24 25	24 12	23 59	23 46	23 20	23 07	22 54	36
40	32 00	31 28	31 12	30 56	30 24	30 08	29 52	29 36	29 20	28 48	28 32	28 16	40
44	38 43	38 05	37 46	37 26	36 47	36 28	36 09	35 49	35 30	34 51	34 32	34 12	44
48	46 05	45 18	44 55	44 32	43 46	43 23	43 00	42 37	42 14	41 28	41 05	40 42	48
52	54 05	53 10	52 43	52 16	51 22	50 55	50 38	50 01	49 34	48 40	48 13	47 46	52
56	62 43	61 41	61 10	60 38	59 35	59 04	58 33	58 01	57 30	56 27	55 56	55 24	56
60	72 00	70 48	70 12	69 36	68 24	67 48	67 12	66 36	66 00	64 48	64 12	63 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.20	1.18	1.17	1.16	1.14	1.13	1.12	1.11	1.10	1.08	1.07	1.06	$\triangle_1$h
Log.	0.079 18	0.071 88	0.068 19	0.064 46	0.056 90	0.053 08	0.049 22	0.045 32	0.041 39	0.033 42	0.029 38	0.025 31	Log.
Limit	65	65	66	67	67	67	68	69	70	70	71	72	Minutes
Meridian	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	Altitudes

Latitude 55° Declination Contrary Name.

DECLINATIONS.

4 21

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 16	0 16	0 16	0 15	0 15	...	...	...	...	...	4
8	1 07	1 05	1 05	1 05	1 04	1 03	1 03	...	...	...	...	...	8
12	2 31	2 28	2 26	2 25	2 24	2 23	2 21	...	...	...	...	...	12
16	4 29	4 24	4 40	4 19	4 16	4 13	4 11	...	...	...	...	...	16
20	7 00	6 52	6 48	6 44	6 40	6 36	6 32	...	...	...	...	...	20
24	10 05	9 53	9 48	9 42	9 36	9 30	9 24	...	...	...	...	...	24
28	13 43	13 28	13 20	13 12	13 04	12 57	12 49	...	...	...	...	...	28
32	17 55	17 35	17 24	17 14	17 04	16 54	16 44	...	...	...	...	...	32
36	22 41	22 15	22 00	21 49	21 36	21 23	21 10	...	...	...	...	...	36
40	28 00	27 28	27 12	26 56	26 40	26 24	26 08	...	...	...	...	...	40
44	33 53	33 14	32 55	32 35	32 16	31 56	31 37	...	...	...	...	...	44
48	40 19	39 33	39 10	38 47	38 24	38 01	37 38	...	...	...	...	...	48
52	47 19	46 25	45 58	45 31	45 04	44 37	44 10	...	...	...	...	...	52
56	54 53	53 50	53 19	52 47	52 16	51 44	51 13	...	...	...	...	...	56
60	63 00	61 48	61 12	60 36	60 00	59 24	58 48	...	...	...	...	...	56
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.05	1.03	1.02	1.01	1.00	0.99	0.98	...	...	...	...	...	$\triangle_1 h$
Log.	0.021 19	0.012 84	0.008 60	0.004 32	0.00 ...	9.995 64	9.991 23	... ...	... ...	... ...	... ...	... ...	Log.
Limit	73	74	75	76	77	78	80						Minutes
Meridian	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	0 14	0 14	0 14	0 14	0 13	0 13	0 12	0 12	4
8	...	...	...	...	0 56	0 54	0 54	0 53	0 52	0 52	0 51	0 50	8
12	...	...	...	...	2 05	2 02	2 01	1 59	1 58	1 56	1 54	1 53	12
16	...	...	...	...	3 43	3 38	3 35	3 33	3 30	3 28	3 22	3 19	16
20	...	...	...	...	5 48	5 40	5 36	5 32	5 28	5 24	5 16	5 12	20
24	...	...	...	...	8 21	8 10	8 04	7 58	7 53	7 47	7 35	7 29	24
28	...	...	...	...	11 22	11 06	10 58	10 51	10 43	10 35	10 20	10 12	28
32	...	...	...	...	14 51	14 30	14 20	14 10	13 59	13 49	13 29	13 19	32
36	...	...	...	...	18 48	18 22	18 09	17 56	17 43	17 30	17 04	16 51	36
40	...	...	...	...	23 12	22 40	22 24	22 08	21 52	21 36	21 04	20 48	40
44	...	...	...	...	28 05	27 26	27 06	26 47	26 28	26 08	25 29	25 10	44
48	...	...	...	...	33 24	32 38	32 15	31 52	31 29	31 06	30 18	29 55	48
52	...	...	...	...	39 12	38 18	37 51	37 24	36 57	36 30	35 36	35 09	52
56	...	...	...	...	45 29	44 26	43 54	43 23	42 52	42 20	41 17	40 46	56
60	...	...	...	...	52 12	51 00	50 24	49 48	49 12	48 36	47 24	46 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	0.87	0.85	0.84	0.83	0.82	0.81	0.79	0.78	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	9.939 52	9.929 42	9.924 28	9.919 08	9.913 81	9.908 49	9.897 63	9.892 09	Log.
Limit					80	79	78	77	76	75	74	73	Minutes
Meridian	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	Altitudes

Declinations. — Inferior Meridian.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	4
8	0 50	0 48	0 48	0 47	0 46	0 46	0 44	0 44	0 43	0 42	0 41	0 40	8
12	1 51	1 48	1 47	1 45	1 44	1 42	1 39	1 38	1 36	1 35	1 33	1 30	12
16	3 17	3 12	3 09	3 07	3 04	3 02	2 57	2 54	2 52	2 49	2 47	2 42	16
20	5 08	5 00	4 56	4 52	4 48	4 44	4 36	4 32	4 28	4 24	4 20	4 12	20
24	7 23	7 12	7 06	7 00	6 55	6 49	6 38	6 32	6 26	6 21	6 15	6 03	24
28	10 04	9 48	9 40	9 33	9 25	9 17	9 01	8 53	8 45	8 37	8 29	8 14	28
32	13 09	12 48	12 38	12 28	12 17	12 07	11 46	11 36	11 26	11 15	11 05	10 45	32
36	16 38	16 12	15 59	15 46	15 33	15 20	14 55	14 42	14 29	14 16	14 03	13 37	36
40	20 32	20 00	19 44	19 28	19 12	18 56	18 24	18 08	17 52	17 36	17 20	16 48	40
44	24 51	24 12	23 52	23 33	23 14	22 54	22 16	21 57	21 38	21 18	20 59	20 20	44
48	29 32	28 46	28 23	28 00	27 37	27 14	26 29	26 06	25 43	25 20	24 57	24 11	48
52	34 42	33 48	33 21	32 54	32 27	32 00	31 05	30 38	30 11	29 44	29 17	28 23	52
56	40 15	39 12	38 40	38 09	37 38	37 06	36 04	35 33	35 02	34 30	33 59	32 56	56
60	46 12	45 00	44 24	43 48	43 12	42 36	41 24	40 48	40 12	39 36	39 00	37 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.77	0.75	0.74	0.73	0.72	0.71	0.69	0.68	0.67	0.66	0.65	0.63	$\triangle_1 h$
Log.	9.886 49	9.875 06	9.869 23	9.863 32	9.857 33	9.851 26	9.838 85	9.832 51	9.826 07	9.819 54	9.812 91	9.799 34	Log.
Limit	80	80	80	80	80	80	80	80	80	80	80	80	Minutes
Meridian	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	Altitudes

Declinations. — Inferior Meridian.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 10	0 10	0 09	0 09	0 09	0 09	0 09	0 08	0 08	0 08	0 07	0 07	4
8	0 39	0 39	0 38	0 37	0 37	0 35	0 35	0 33	0 32	0 31	0 30	0 29	8
12	1 29	1 27	1 25	1 22	1 21	1 18	1 16	1 15	1 12	1 09	1 07	1 04	12
16	2 39	2 37	2 31	2 26	2 23	2 18	2 16	2 13	2 08	2 03	1 57	1 52	16
20	4 08	4 04	3 56	3 48	3 44	3 36	3 32	3 28	3 20	3 12	3 04	2 56	20
24	5 58	5 52	5 40	5 28	5 23	5 11	5 05	5 00	4 48	4 36	4 25	4 13	24
28	8 06	7 58	7 43	7 27	7 19	7 03	6 56	6 48	6 32	6 16	6 01	5 45	28
32	10 34	10 24	10 04	9 44	9 33	9 13	9 03	8 52	8 32	8 12	7 51	7 31	32
36	13 24	13 11	12 45	12 19	12 06	11 40	11 27	11 14	10 48	10 22	9 56	9 30	36
40	16 32	16 16	15 44	15 12	14 56	14 24	14 08	13 52	13 20	12 48	12 16	11 48	40
44	20 01	19 41	19 02	18 24	18 04	17 25	17 06	16 47	16 08	15 29	14 50	14 11	44
48	23 48	23 25	22 39	21 53	21 30	20 44	20 21	19 58	19 12	18 26	17 40	16 54	48
52	27 56	27 29	26 35	25 41	25 14	24 20	23 53	23 26	22 32	21 38	20 46	19 50	52
56	32 25	31 53	30 50	29 48	29 16	28 13	27 42	27 11	26 08	25 05	24 04	22 59	56
60	37 12	36 36	35 24	34 12	33 16	32 24	31 48	31 12	30 00	28 48	27 36	26 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.62	0.61	0.59	0.57	0.56	0.54	0.53	0.52	0.50	0.48	0.46	0.44	$\triangle_1 h$
Log.	9.792 39	9.785 33	9.770 85	9.755 87	9.748 19	9.732 39	9.724 28	9.716 00	9.698 97	9.681 24	9.662 76	9.643 45	Log.
Limit	80	80	80	80	80	80	80	80	80	80	80	81	Minutes
Meridian	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	36°	Altitudes

Latitude 56° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 21	0 22	0 22	0 22	0 22	0 22	0 22	0 22	0 23	0 23	0 24	0 24	4
8	1 24	1 26	1 27	1 28	1 29	1 30	1 32	1 33	1 34	1 35	1 36	1 37	8
12	3 10	3 13	3 16	3 17	3 20	3 23	3 24	3 28	3 31	3 34	3 36	3 39	12
16	5 38	5 43	5 48	5 51	5 56	6 01	6 06	6 08	6 13	6 18	6 24	6 29	16
20	8 48	8 56	9 04	9 08	9 16	9 24	9 32	9 36	9 44	9 52	10 00	10 08	20
24	12 41	12 52	13 04	13 09	13 21	13 32	13 43	13 49	14 01	14 12	14 24	14 36	24
28	17 15	17 30	17 46	17 54	18 10	18 26	18 42	18 49	19 05	19 21	19 36	19 52	28
32	22 31	22 52	23 12	23 23	23 43	24 04	24 25	24 35	24 55	25 16	25 36	25 56	32
36	28 31	28 57	29 23	29 36	30 02	30 27	30 53	31 06	31 32	31 58	32 24	32 50	36
40	35 12	35 44	36 16	36 32	37 04	37 36	38 08	38 24	38 56	39 28	40 00	40 32	40
44	42 36	43 14	43 53	44 13	44 51	45 29	46 08	46 27	47 06	47 45	48 24	49 03	44
48	50 41	51 27	52 13	52 36	53 22	54 09	54 55	55 18	56 04	56 50	57 36	58 22	48
52	59 29	60 23	61 17	61 44	62 38	63 33	64 27	64 54	65 48	66 42	67 36	68 30	52
56	69 00	70 02	71 05	71 37	72 39	73 41	74 44	75 15	76 18	77 21	78 24	79 27	56
60	79 12	80 24	81 36	82 12	83 24	84 36	85 48	86 24	87 36	88 48	90 00	91 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.32	1.34	1.36	1.37	1.39	1.41	1.43	1.44	1.46	1.48	1.50	1.52	Δ_1h
Log.	0.120 57	0.127 10	0.133 54	0.136 72	0.143 01	0.149 22	0.155 34	0.158 36	0.164 35	0.170 26	0.176 09	0.181 84	Log.
Limit	59	59	58	57	57	56	56	55	55	54	54	53	Minutes
Meridian	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 25	0 25	0 26	0 27	0 27	0 27	0 27	0 28	0 28	0 29	0 30	4
8	1 39	1 41	1 42	1 43	1 45	1 47	1 49	1 51	1 53	1 55	1 56	1 59	8
12	3 43	3 46	3 49	3 53	3 56	4 00	4 03	4 09	4 14	4 18	4 22	4 28	12
16	6 37	6 42	6 47	6 55	7 00	7 08	7 15	7 23	7 30	7 38	7 46	7 56	16
20	10 20	10 28	10 36	10 48	10 56	11 08	11 20	11 32	11 44	11 56	12 08	12 24	20
24	14 53	15 04	15 16	15 34	15 45	16 02	16 19	16 36	16 54	17 11	17 29	17 52	24
28	20 15	20 31	20 47	21 10	21 25	21 49	22 13	22 37	23 00	23 24	23 47	24 18	28
32	26 27	26 48	27 08	27 38	27 59	28 30	29 01	29 32	30 02	30 33	31 03	31 44	32
36	33 29	33 55	34 21	35 00	35 26	36 05	36 43	37 22	38 01	38 40	39 19	40 11	36
40	41 20	41 52	42 24	43 12	43 44	44 32	45 20	46 08	46 56	47 44	48 32	49 36	40
44	50 01	50 40	51 18	52 17	52 55	53 54	54 51	55 49	56 47	57 45	58 44	60 01	44
48	59 31	60 17	61 03	62 12	62 58	64 07	65 15	66 24	67 33	68 42	69 53	71 25	48
52	69 51	70 45	71 39	73 00	73 54	75 15	76 37	77 58	79 19	80 40	82 01	83 49	52
56	81 01	82 04	83 06	84 41	85 43	87 18	88 51	90 25	91 59	93 33	95 08	97 13	56
60	93 00	94 12	95 24	97 12	98 24	100 12	102 00	103 48	105 36	107 24	109 12	111 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.55	1.57	1.59	1.62	1.64	1.67	1.70	1.73	1.76	1.79	1.82	1.86	Δ_1h
Log.	0.190 33	0.195 90	0.201 40	0.209 52	0.214 84	0.222 72	0.230 45	0.238 05	0.245 51	0.252 85	0.260 07	0.269 51	Log.
Limit	52	52	51	51	50	49	49	48	47	46	45	44	Minutes
Meridian	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 31	0 32	0 32	0 33	0 34	0 35	0 36	0 37	0 38	0 39	0 40	4
8	2 01	2 03	2 06	2 09	2 11	2 15	2 18	2 23	2 27	2 32	2 35	2 40	8
12	4 32	4 39	4 44	4 51	4 58	5 04	5 13	5 21	5 29	5 39	5 49	6 01	12
16	8 04	8 14	8 24	8 37	8 46	9 01	9 15	9 31	9 47	10 05	10 23	10 44	16
20	12 36	12 52	13 08	13 28	13 44	14 04	14 28	14 53	15 16	15 44	16 12	16 42	20
24	18 09	18 31	18 44	19 23	19 46	20 16	20 50	21 25	22 00	22 40	23 20	24 06	24
28	24 42	25 13	25 45	25 25	26 55	27 34	28 21	29 09	29 55	30 50	31 45	23 48	28
32	32 15	32 57	33 38	34 29	35 10	36 00	37 02	38 03	39 05	40 16	41 28	42 50	32
36	40 50	41 41	42 33	43 38	44 30	45 35	46 53	48 10	49 28	50 59	52 29	54 13	36
40	50 24	51 28	52 32	53 52	54 56	56 16	57 52	59 28	61 04	62 56	64 48	66 56	40
44	60 59	62 16	63 34	65 11	66 28	68 05	70 02	71 57	73 53	76 09	...	...	44
48	72 34	74 07	75 39	77 34	79 06	81 01	83 19	...	...	...	...	...	48
52	85 10	86 59	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.89	1.93	1.97	2.02	2.06	2.11	2.17	2.23	2.29	2.36	2.43	2.51	$\Delta_1 h$
Log.	0.276 46	0.285 56	0.294 47	0.305 35	0.313 87	0.324 28	0.336 46	0.348 30	0.359 84	0.372 91	0.385 61	0.399 67	Log.
Limit	43	43	42	41	41	40	39	38	37	37	36	35	Minutes
Meridian	58°	59°	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 42	0 43	0 45	0 47	0 49	0 51	0 54	0 57	1 01	1 05	1 10	1 17	4
8	2 47	2 52	3 00	3 07	3 15	3 25	3 36	3 48	4 04	4 20	4 41	5 06	8
12	6 15	6 27	6 44	7 00	7 19	7 41	8 06	8 34	9 08	9 46	10 33	11 29	12
16	11 06	11 28	11 58	12 27	12 59	13 40	14 24	15 13	16 14	17 22	18 45	20 25	16
20	17 20	17 55	18 41	19 28	20 20	21 21	22 29	23 47	25 21	27 08	29 17	31 56	20
24	24 58	25 48	26 54	28 02	29 17	30 44	32 22	34 16	36 30	39 05	42 09	45 59	24
28	33 58	35 09	36 36	38 10	39 51	41 49	44 02	46 39	49 39	53 11	57 22	62 34	28
32	44 22	45 55	47 47	49 50	52 03	54 37	57 31	60 56	...	...	...	...	32
36	56 10	58 07	60 29	63 04	65 53	69 07	...	...	...	...	...	...	36
40	69 20	71 44	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.60	2.69	2.80	2.92	3.05	3.20	3.37	3.57	3.80	4.07	4.39	4.79	$\Delta_1 h$
Log.	0.414 97	0.429 75	0.447 16	0.465 38	0.484 30	0.505 15	0.527 63	0.552 67	0.579 78	0.609 59	0.642 46	0.680 34	Log.
Limit	34	33	32	31	30	29	28	26	25	24	22	20	Minutes
Meridian	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	81°	Altitudes

Latitude 56° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 24	1 34	1 48	2 07	...	...	...	...	...	...	...	...	4
8	5 37	6 18	7 13	8 27	...	...	...	...	...	...	...	...	8
12	12 41	14 12	16 12	18 59	...	...	...	...	...	...	...	...	12
16	22 30	25 14	28 48	33 50	...	...	...	...	...	...	...	...	16
20	35 12	39 24	45 00	...	...	...	...	...	...	...	...	...	20
24	50 41	...	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	5.28	5.91	6.75	7.93	...	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.722 63	0.771 59	0.829 30	0.899 27	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	20	18	16	14	12	9	6	3	0	3	6	9	Minutes
Meridian	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	87°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	1 37	1 19	1 06	0 55	0 47	0 41	0 36	0 31	0 27	0 25	0 22	4
8	...	6 30	5 19	4 22	3 41	3 10	2 45	2 25	2 06	1 52	1 39	1 26	8
12	...	14 39	11 58	9 49	8 19	7 08	6 10	5 24	4 46	4 12	3 43	3 14	12
16	...	26 05	21 14	17 25	14 45	12 40	10 58	9 36	8 26	7 28	6 37	5 46	16
20	...	...	33 12	27 16	23 04	19 48	17 08	15 00	13 12	11 40	10 20	9 00	20
24	...	...	...	39 16	33 13	28 30	24 40	21 36	19 00	16 48	14 53	12 58	24
28	...	...	...	...	45 13	38 49	33 35	29 24	25 53	22 52	20 15	17 38	28
32	...	...	...	...	...	...	43 52	38 24	33 48	29 52	26 27	23 02	32
36	...	...	...	...	...	...	...	48 36	42 46	37 48	33 29	29 10	36
40	...	...	...	...	...	...	...	...	52 48	46 40	41 20	36 00	40
44	...	...	...	...	...	...	...	...	...	56 28	50 01	43 34	44
48	...	...	...	...	...	...	...	...	...	...	59 31	51 50	48
52	...	...	...	...	...	...	...	...	...	...	...	60 50	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	6.11	4.98	4.09	3.46	2.97	2.57	2.25	1.98	1.75	1.55	1.35	$\triangle_1 h$
Log.	... ...	0.786 04	0.697 23	0.611 72	0.539 08	0.472 76	0.409 93	0.352 18	0.296 67	0.243 04	0.190 33	0.130 33	Log.
Limit	12	14	18	20	22	24	27	30	33	36	39	42	Minutes
Meridian	85°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	75°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 21	0 21	0 20	0 20	0 20	0 20	0 20	0 19	0 19	0 19	0 19	0 19	4
8	1 24	1 23	1 23	1 22	1 21	1 20	1 20	1 18	1 17	1 17	1 15	1 15	8
12	3 10	3 08	3 06	3 05	3 02	3 00	2 59	2 56	2 54	2 53	2 50	2 48	12
16	5 38	5 36	5 30	5 27	5 22	5 20	5 17	5 12	5 10	5 07	5 02	5 00	16
20	8 48	8 44	8 36	8 32	8 24	8 20	8 16	8 08	8 04	8 00	7 52	7 48	20
24	12 41	12 35	12 23	12 17	12 06	12 00	11 54	11 43	11 37	11 31	11 20	11 14	24
28	17 15	17 07	16 52	16 44	16 28	16 20	16 12	15 57	15 49	15 41	15 25	15 17	28
32	22 31	22 21	22 01	21 51	21 30	21 20	21 10	20 49	20 39	20 29	20 08	19 58	32
36	28 31	28 18	27 52	27 39	27 13	27 00	26 47	26 21	26 08	25 55	25 30	25 17	36
40	35 12	34 56	34 24	34 08	33 36	33 20	33 04	32 32	32 16	32 00	31 28	31 12	40
44	42 36	42 16	41 37	41 18	40 39	40 20	40 00	39 22	39 02	38 43	38 05	37 46	44
48	50 41	50 18	49 32	49 09	48 23	48 00	47 37	46 51	46 28	46 05	45 18	44 55	48
52	59 29	59 02	58 08	57 41	56 47	56 20	55 53	54 59	54 32	54 05	53 10	52 43	52
56	69 00	68 28	67 25	66 54	65 51	65 20	64 48	63 46	63 14	62 43	61 41	61 10	56
60	79 12	78 36	77 24	76 48	75 36	75 00	74 24	73 12	72 36	72 00	70 48	70 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.32	1.31	1.29	1.28	1.26	1.25	1.24	1.22	1.21	1.20	1.18	1.17	Δ_1h
Log.	0.120 57	0.117 27	0.110 59	0.107 21	0.100 37	0.096 91	0.093 42	0.086 36	0.082 79	0.079 18	0.071 88	0.068 19	Log.
Limit	59	59	60	61	62	62	62	63	64	65	65	65	Minutes
Meridian	34°	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 18	0 18	0 18	0 18	0 17	0 17	0 17	0 17	0 17	0 16	4
8	1 14	1 13	1 12	1 11	1 11	1 10	1 10	1 08	1 08	1 07	1 07	1 06	8
12	2 47	2 45	2 42	2 41	2 39	2 38	2 37	2 34	2 33	2 31	2 30	2 28	12
16	4 57	4 55	4 50	4 47	4 45	4 42	4 39	4 34	4 31	4 29	4 26	4 24	16
20	7 44	7 40	7 32	7 28	7 24	7 20	7 16	7 08	7 04	7 00	6 56	6 52	20
24	11 09	11 03	10 51	10 46	10 40	10 34	10 28	10 16	10 11	10 05	9 59	9 53	24
28	15 09	15 01	14 46	14 38	14 30	14 22	14 15	13 59	13 51	13 43	13 35	13 28	28
32	19 47	19 37	19 17	19 06	18 56	18 46	18 36	18 16	18 05	17 55	17 45	17 35	32
36	25 04	24 51	24 25	24 12	23 59	23 46	23 33	23 07	22 54	22 41	22 28	22 15	36
40	30 56	30 40	30 08	29 52	29 36	29 20	29 04	28 32	28 16	28 00	27 44	27 28	40
44	37 26	37 07	36 28	36 09	35 49	35 30	35 10	34 32	34 12	33 53	33 33	33 14	44
48	44 32	44 09	43 23	43 00	42 37	42 14	41 51	41 05	40 42	40 19	39 56	39 33	48
52	52 16	51 49	50 55	50 28	50 01	49 34	49 07	48 13	47 46	47 19	46 52	46 25	52
56	60 38	60 07	59 04	58 33	58 01	57 30	56 58	55 56	55 24	54 53	54 21	53 50	56
60	69 36	69 00	67 48	67 12	66 36	66 00	65 24	64 12	63 36	63 00	62 24	61 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.16	1.15	1.13	1.12	1.11	1.10	1.09	1.07	1.06	1.05	1.04	1.03	Δ_1h
Log.	0.064 46	0.060 70	0.053 08	0.049 22	0.045 32	0.041 39	0.037 43	0.029 38	0.250 31	0.021 19	0.017 03	0.012 89	Log.
Limit	66	67	68	68	68	69	70	71	72	72	73	74	Minutes
Meridian	22°	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	Altitudes

Latitude 56° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 16	0 16	0 15	0 15	0 15	0 15	...	...	...	...	...	...	4
8	1 05	1 04	1 03	1 03	1 02	1 01	...	...	...	...	...	...	8
12	2 27	2 24	2 23	2 21	2 20	2 19	...	...	...	...	...	...	12
16	4 21	4 16	4 13	4 11	4 08	4 05	...	...	...	...	...	...	16
20	6 48	6 40	6 36	6 32	6 28	6 24	...	...	...	...	...	...	20
24	9 48	9 36	9 30	9 24	9 18	9 13	...	...	...	...	...	...	24
28	13 20	13 04	12 57	12 49	12 41	12 33	...	...	...	...	...	...	28
32	17 24	17 04	16 54	16 42	16 34	16 23	...	...	...	...	...	...	32
36	22 02	21 36	21 23	21 08	20 57	20 44	...	...	...	...	...	...	36
40	27 12	26 40	26 24	26 08	25 52	25 36	...	...	...	...	...	...	40
44	32 55	32 16	31 56	31 37	31 18	30 58	...	...	...	...	...	...	44
48	39 10	38 24	38 01	37 38	37 15	36 52	...	...	...	...	...	...	48
52	45 58	45 04	44 37	44 10	43 43	43 16	...	...	...	...	...	...	52
56	53 19	52 16	51 44	51 13	50 42	50 10	...	...	...	...	...	...	56
60	61 12	60 00	59 24	58 48	58 12	57 36	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.02	1.00	0.99	0.98	0.97	0.96	...	...	...	...	...	...	$\triangle_1$h
Log.	0.008 60	0.00 ...	9.995 64	9.991 23	9.986 77	9.982 27	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	75	75	76	77	78	79							Minutes
Meridian	10°	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	0 14	0 14	0 14	0 13	0 13	0 13	0 12	0 12	0 12	4
8	...	...	...	0 55	0 54	0 53	0 52	0 52	0 51	0 51	0 50	0 50	8
12	...	...	...	2 04	2 01	1 59	1 58	1 56	1 55	1 54	1 53	1 51	12
16	...	...	...	3 40	3 35	3 33	3 30	3 28	3 25	3 22	3 19	3 17	16
20	...	...	...	5 44	5 36	5 32	5 28	5 24	5 20	5 16	5 12	5 08	20
24	...	...	...	8 16	8 04	7 58	7 53	7 47	7 41	7 35	7 29	7 23	24
28	...	...	...	11 14	10 58	10 51	10 43	10 35	10 27	10 20	10 12	10 04	28
32	...	...	...	14 40	14 20	14 10	13 59	13 49	13 39	13 29	13 19	13 09	32
36	...	...	...	18 35	18 09	17 56	17 43	17 30	17 17	17 04	16 51	16 38	36
40	...	...	...	22 56	22 24	22 08	21 52	21 36	21 20	21 04	20 48	20 32	40
44	...	...	...	27 45	27 06	26 47	26 28	26 08	25 49	25 29	25 10	24 51	44
48	...	...	...	33 01	32 15	31 52	31 29	31 06	30 43	30 18	29 55	29 32	48
52	...	...	...	38 45	37 51	37 24	36 57	36 30	36 03	35 36	35 09	34 42	52
56	...	...	...	44 57	43 54	43 23	42 52	42 20	41 49	41 17	40 46	40 15	56
60	...	...	...	51 36	50 24	49 48	49 12	48 36	48 00	47 24	46 48	46 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	0.86	0.84	0.83	0.82	0.81	0.80	0.79	0.78	0.77	$\triangle_1$h
Log.	... ...	... ...	... ...	9.934 50	9.924 28	9.919 08	9.913 81	9.908 49	9.903 09	9.897 63	9.892 09	9.886 49	Log.
Limit				83	83	83	83	83	83	83	83	83	Minutes
Meridian	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 10	4
8	0 48	0 48	0 47	0 46	0 46	0 45	0 44	0 43	0 42	0 41	0 40	0 39	8
12	1 48	1 47	1 45	1 44	1 42	1 41	1 39	1 36	1 35	1 33	1 30	1 29	12
16	3 12	3 09	3 07	3 04	3 02	2 59	2 57	2 52	2 49	2 47	2 42	2 39	16
20	5 00	4 56	4 52	4 48	4 44	4 40	4 36	4 28	4 24	4 20	4 12	4 08	20
24	7 12	7 06	7 00	6 55	6 49	6 43	6 38	6 26	6 21	6 15	6 03	5 58	24
28	9 48	9 40	9 33	9 25	9 17	9 09	9 01	8 45	8 37	8 29	8 14	8 06	28
32	12 48	12 38	12 28	12 17	12 07	11 57	11 46	11 26	11 15	11 05	10 45	10 34	32
36	16 12	15 59	15 46	15 33	15 20	15 07	14 55	14 29	14 16	14 03	13 37	13 24	36
40	20 00	19 44	19 28	19 12	18 56	18 40	18 24	17 52	17 36	17 20	16 48	16 32	40
44	24 12	23 52	23 33	23 14	22 54	22 35	22 16	21 38	21 18	20 59	20 20	20 01	44
48	28 46	28 23	28 00	27 37	27 14	26 51	26 29	25 43	25 20	24 57	24 11	23 48	48
52	33 48	33 21	32 54	32 27	32 00	31 33	31 05	30 11	29 44	29 17	28 33	27 56	52
56	39 12	38 40	38 09	37 38	37 06	36 35	36 04	35 02	34 30	33 59	32 56	32 25	56
60	45 00	44 24	43 48	43 12	42 36	42 00	41 24	40 12	39 36	39 00	37 48	37 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	0.75	0.74	0.73	0.72	0.71	0.70	0.69	0.67	0.66	0.65	0.63	0.62	△₁h
Log.	9.875 06	9.859 23	9.863 32	9.857 33	9.851 26	9.845 10	9.838 85	7.826 07	9.819 54	9.812 91	9.799 34	9.792 39	Log.
Limit	83	83	83	83	83	83	83	83	83	83	83	83	Minutes
Meridian	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 10	0 10	0 09	0 09	0 09	0 09	0 09	0 08	0 08	0 07	0 07	0 07	4
8	0 39	0 38	0 38	0 37	0 37	0 36	0 35	0 32	0 31	0 31	0 30	0 29	8
12	1 27	1 26	1 24	1 22	1 21	1 18	1 16	1 13	1 11	1 08	1 07	1 04	12
16	2 37	2 34	2 28	2 26	2 23	2 18	2 16	2 11	2 05	2 00	1 57	1 52	16
20	4 04	4 00	3 52	3 48	3 44	3 36	3 32	3 24	3 16	3 08	3 04	2 56	20
24	5 52	5 46	5 34	5 28	5 23	5 11	5 05	4 54	4 42	4 30	4 25	4 13	24
28	7 58	7 50	7 35	7 27	7 19	7 03	6 56	6 40	6 25	6 09	6 01	5 45	28
32	10 24	10 14	9 54	9 44	9 33	9 13	9 03	8 42	8 22	8 02	7 51	7 31	32
36	13 11	12 58	12 32	12 19	12 06	11 40	11 27	11 01	10 35	10 09	9 56	9 30	36
40	16 16	16 00	15 28	15 12	14 56	14 24	14 08	13 36	13 04	12 32	12 16	11 44	40
44	19 41	19 22	18 43	18 24	18 04	17 25	17 06	16 27	15 48	15 10	14 50	14 11	44
48	23 25	23 02	22 16	21 53	21 30	20 44	20 21	19 35	18 49	18 03	17 40	16 54	48
52	27 29	27 02	26 08	25 41	25 14	24 20	23 53	22 59	22 05	21 11	20 46	19 50	52
56	31 53	31 22	30 19	29 48	29 16	28 13	27 42	26 39	25 36	24 34	24 02	22 59	56
60	36 36	36 00	34 48	34 12	33 36	32 24	31 48	30 36	29 24	28 12	27 36	26 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	0.61	0.60	0.58	0.57	0.56	0.54	0.53	0.51	0.49	0.47	0.46	0.44	△₁h
Log.	9.785 33	9.778 15	9.763 43	9.755 87	9.748 19	9.732 39	9.724 28	9.707 57	9.690 20	9.672 10	9.662 76	9.643 45	Log.
Limit	83	83	83	83	83	83	83	83	83	83	83	83	Minutes
Meridian	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	36°	37°	Altitudes

Latitude 57° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 20	0 21	0 21	0 22	0 22	0 22	0 22	0 22	0 22	0 22	0 23	4
8	1 22	1 23	1 23	1 24	1 26	1 26	1 28	1 29	1 30	1 31	1 33	1 34	8
12	3 05	3 06	3 07	3 10	3 13	3 14	3 17	3 20	3 22	3 25	3 28	3 31	12
16	5 27	5 30	5 33	5 38	5 43	5 46	5 51	5 56	5 58	6 03	6 08	6 13	16
20	8 32	8 36	8 40	8 48	8 56	9 00	9 08	9 16	9 20	9 28	9 36	9 44	20
24	12 17	12 23	12 29	12 41	12 52	12 58	13 09	13 21	13 26	13 38	13 49	14 01	24
28	16 44	16 52	16 59	17 15	17 30	17 38	17 54	18 10	18 18	18 34	18 49	19 05	28
32	21 51	22 01	22 11	22 31	22 52	23 02	23 23	23 43	23 54	24 14	24 35	24 55	32
36	27 39	27 52	28 05	28 31	28 57	29 10	29 36	30 02	30 14	30 40	31 06	31 32	36
40	34 08	34 24	34 40	35 12	35 44	36 00	36 32	37 04	37 20	37 52	38 24	38 56	40
44	41 18	41 37	41 57	42 36	43 14	43 34	44 13	44 51	45 10	45 49	46 27	47 06	44
48	49 09	49 32	49 55	50 41	51 27	51 50	52 36	53 22	53 46	54 32	55 18	56 04	48
52	57 41	58 08	58 35	59 29	60 23	60 50	61 44	62 38	63 06	64 00	64 54	65 48	52
56	66 54	67 25	67 57	69 00	70 02	70 34	71 37	72 39	73 10	74 13	75 15	76 18	56
60	76 48	77 24	78 00	79 12	80 24	81 00	82 12	83 24	84 00	85 12	86 24	87 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.28	1.29	1.30	1.32	1.34	1.35	1.37	1.39	1.40	1.42	1.44	1.46	$\triangle_1$h
Log.	0.107 21	0.110 59	0.113 94	0.120 57	0.127 10	0.130 33	0.136 72	0.143 01	0.146 13	0.152 29	0.158 36	0.164 35	Log.
Limit	60	60	59	58	58	57	57	56	56	55	55	54	Minutes
Meridian	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 24	0 24	0 25	0 25	0 25	0 26	0 27	0 27	0 27	0 27	0 28	4
8	1 35	1 36	1 37	1 39	1 41	1 42	1 43	1 45	1 47	1 49	1 51	1 53	8
12	3 34	3 36	3 39	3 42	3 46	3 49	3 53	3 56	4 00	4 05	4 09	4 14	12
16	6 18	6 24	6 29	6 34	6 42	6 47	6 55	7 00	7 08	7 15	7 23	7 30	16
20	9 52	10 00	10 08	10 16	10 28	10 36	10 48	10 56	11 08	11 20	11 32	11 44	20
24	14 12	14 24	14 36	14 47	15 04	15 16	15 34	15 45	16 02	16 19	16 36	16 54	24
28	19 21	19 36	19 52	20 07	20 31	20 47	21 10	21 25	21 49	22 13	22 37	23 00	28
32	25 16	25 36	25 56	26 17	26 48	27 08	27 38	27 59	28 30	29 01	29 32	30 02	32
36	31 58	32 24	32 50	33 16	33 55	34 21	35 00	35 26	36 05	36 43	37 22	38 01	36
40	39 28	40 00	40 32	41 04	41 52	42 24	43 12	43 44	44 32	45 20	46 08	46 56	40
44	47 45	48 24	49 03	49 41	50 40	51 18	52 17	52 55	53 54	54 51	55 49	56 47	44
48	56 50	57 36	58 22	59 08	60 17	61 03	62 12	62 58	64 07	65 15	66 24	67 33	48
52	66 42	67 36	68 30	69 24	70 45	71 39	73 00	73 54	75 15	76 37	77 58	79 19	52
56	77 21	78 24	79 27	80 29	82 04	83 06	84 41	85 43	87 18	88 51	90 25	91 59	56
60	88 48	90 00	91 12	92 24	94 12	95 24	97 12	98 24	100 12	102 00	103 48	105 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.48	1.50	1.52	1.54	1.57	1.59	1.62	1.64	1.67	1.70	1.73	1.76	$\triangle_1$h
Log.	0.170 26	0.176 09	0.181 84	0.187 52	0.195 90	0.201 40	0.209 52	0.214 84	0.222 72	0.230 45	0.238 05	0.245 51	Log.
Limit	54	53	52	52	51	50	50	49	49	48	47	46	Minutes
Meridian	45°	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	56°	Altitudes

Latitude 57° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 28	0 28	0 30	0 30	0 31	0 31	0 33	0 33	0 35	0 35	0 36	0 37	4
8	1 55	1 56	2 00	2 02	2 04	2 07	2 11	2 14	2 17	2 22	2 25	2 30	8
12	4 18	4 22	4 29	4 35	4 41	4 47	4 54	5 01	5 09	5 18	7 27	5 37	12
16	7 38	7 46	7 59	8 09	8 19	8 29	8 42	8 55	9 11	9 26	9 40	10 00	16
20	11 56	12 08	12 28	12 44	13 00	13 16	13 36	13 56	14 20	14 44	15 08	15 36	20
24	17 11	17 29	17 57	18 20	18 43	19 06	19 35	20 04	20 39	21 13	21 45	22 27	24
28	23 24	23 47	24 26	24 58	25 29	26 01	26 39	27 19	28 05	28 53	29 40	30 33	28
32	30 33	31 03	31 55	32 36	33 17	33 58	34 49	35 40	36 41	37 43	38 45	39 56	32
36	38 40	39 19	40 24	41 15	42 07	42 59	44 04	45 09	46 27	47 44	49 02	50 33	36
40	47 44	48 32	49 52	50 56	52 00	53 04	54 24	55 44	57 20	58 56	60 32	62 24	40
44	57 45	58 44	60 21	61 37	62 55	64 12	65 49	67 26	69 23	71 18	73 15	75 30	44
48	68 42	69 53	71 48	73 21	74 53	76 25	78 20	80 15	82 33	...	...	...	48
52	80 40	82 01	84 16	86 05	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.79	1.82	1.87	1.91	1.95	1.99	2.04	2.09	2.15	2.21	2.27	2.34	$\Delta_1 h$
Log.	0.252 85	0.260 07	0.271 84	0.281 03	0.290 03	0.298 85	0.309 63	0.320 15	0.332 44	0.344 39	0.356 03	0.369 22	Log.
Limit	45	44	44	43	42	41	41	40	39	38	37	36	Minutes
Meridian	57°	58°	59°	60°	61°	62°	63°	64°	65°	66°	67°	68°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 41	0 41	0 43	0 45	0 47	0 49	0 51	0 55	0 58	1 02	1 07	4
8	2 35	2 40	2 45	2 52	3 00	3 08	3 17	3 26	3 38	3 54	4 09	4 30	8
12	5 47	6 02	6 12	6 29	6 44	7 01	7 23	7 44	8 12	8 45	9 21	10 05	12
16	10 17	10 38	11 02	11 28	11 58	12 30	13 06	13 46	14 36	15 32	16 36	17 54	16
20	16 04	16 40	17 16	17 55	18 41	19 52	20 28	21 30	22 48	24 16	25 56	28 00	20
24	23 08	24 00	24 52	25 48	26 54	28 08	29 28	30 57	32 50	34 57	37 21	40 19	24
28	31.30	32 40	33 51	35 09	36 36	38 18	40 07	42 13	44 52	47 33	50 50	54 53	28
32	41 08	42 40	44 12	45 54	47 47	50 01	52 24	55 08	58 22	62 07	...	...	32
36	52 03	54 00	55 57	58 07	60 29	63 17	66 19	...	...	...	...	...	36
40	64 16	66 40	69 04	71 44	74 40	...	...	...	...	...	...	...	40
44	77 45	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.41	2.50	2.59	2.69	2.80	2.93	3.07	3.23	3.42	3.64	3.89	4.20	$\Delta_1 h$
Log.	0.382 02	0.397 94	0.413 30	0.429 75	0.447 16	0.466 87	0.487 14	0.509 20	0.534 03	0.561 10	0.589 95	0.623 25	Log.
Limit	36	35	34	33	32	31	30	28	27	26	24	22	Minutes
Meridian	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	80°	Altitudes

Latitude 57° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 13	1 21	1 31	1 43	2 00	...	...	...	...	...	...	...	4
8	4 53	5 22	6 01	6 52	8 03	...	...	...	...	...	...	...	8
12	11 00	12 04	13 32	15 28	18 07	...	...	...	...	...	...	...	12
16	19 30	21 30	24 04	27 28	32 13	...	...	...	...	...	...	...	16
20	30 28	33 36	37 36	42 56	...	...	...	...	...	...	...	...	20
24	43 52	48 23	...	...	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	4.57	5.04	5.64	6.44	7.55	...	...	...	...	...	...	...	$\Delta_1 h$
Log.	0.659 92	0.702 43	0.751 28	0.808 89	0.877 95	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	21	19	18	17	14	11	8	6	3	0	3	6	Minutes
Meridian	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	88°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	1 32	1 15	1 02	0 52	0 44	0 38	0 34	0 30	0 26	0 22	4
8	...	...	6 10	5 00	4 07	3 28	2 58	2 35	2 14	1 58	1 44	1 31	8
12	...	...	13 48	11 15	9 15	7 48	6 40	5 47	5 02	4 25	3 54	3 25	12
16	...	...	24 34	20 00	16 26	13 52	11 52	10 17	8 58	7 51	6 58	6 03	16
20	...	...	38 24	31 16	25 40	21 40	18 32	16 04	14 00	12 14	10 52	9 58	20
24	...	...	...	...	36 58	31 12	26 41	23 08	20 10	17 40	15 39	13 38	24
28	...	...	...	...	...	42 28	36 18	31 30	27 26	24 02	21 18	18 34	28
32	...	...	...	...	...	...	47 27	41 08	35 50	31 24	27 49	24 14	32
36	...	...	...	...	...	...	...	52 03	45 22	39 45	35 13	30 40	36
40	...	...	...	...	...	...	...	...	56 00	49 04	43 28	37 52	40
44	...	...	...	...	...	...	...	...	...	59 22	52 36	45 49	44
48	...	...	...	...	...	...	...	...	...	...	62 35	54 32	48
52	...	...	...	...	...	...	...	...	...	...	...	64 00	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	5.76	4.69	3.85	3.25	2.78	2.41	2.10	1.84	1.63	1.42	$\Delta_1 h$
Log.	... ...	... ...	0.760 42	0.671 17	0.585 46	0.511 88	0.444 04	0.382 02	0.322 22	0.264 82	0.212 19	0.152 29	Log.
Limit	9	12	15	18	20	22	25	28	31	34	37	40	Minutes
Meridian	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	76°	Altitudes

Latitude 57° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 20	0 20	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 18	4
8	1 22	1 21	1 20	1 19	1 18	1 17	1 16	1 15	1 15	1 14	1 13	1 12	8
12	3 05	3 02	3 00	2 57	2 56	2 54	2 51	2 50	2 48	2 47	2 44	2 42	12
16	5 27	5 22	5 20	5 15	5 12	5 10	5 05	5 02	5 00	4 57	4 52	4 50	16
20	8 32	8 24	8 20	8 12	8 08	8 04	7 56	7 52	7 48	7 44	7 36	7 32	20
24	12 17	12 06	12 00	11 48	11 43	11 37	11 26	11 20	11 14	11 09	10 57	10 51	24
28	16 44	16 28	16 20	16 05	15 57	15 49	15 33	15 25	15 17	15 09	14 53	14 46	28
32	21 51	21 30	21 20	21 00	20 49	20 39	20 18	20 08	19 58	19 47	19 27	19 17	32
36	27 39	27 13	27 00	26 34	26 21	26 08	25 43	25 30	25 17	25 04	24 38	24 25	36
40	34 08	33 36	33 20	32 48	32 32	32 16	31 44	31 28	31 12	30 56	30 24	30 08	40
44	41 18	40 39	40 20	39 41	39 22	39 02	38 24	38 05	37 46	37 26	36 47	36 28	44
48	49 09	48 23	48 00	47 14	46 51	46 28	45 41	45 18	44 55	44 32	43 46	43 23	48
52	57 41	56 47	56 20	55 26	54 59	54 32	53 37	53 10	52 43	52 16	51 22	50 55	52
56	66 54	65 51	65 20	64 17	63 46	63 14	62 12	61 41	61 10	60 38	59 35	59 04	56
60	76 48	75 36	75 00	73 48	73 12	72 36	71 24	70 48	70 12	69 36	68 24	67 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.28	1.26	1.25	1.23	1.22	1.21	1.19	1.18	1.17	1.16	1.14	1.13	$\triangle_1 h$
Log.	0.107 21	0.100 37	0.096 91	0.089 91	0.086 36	0.082 79	0.075 55	0.071 88	0.068 19	0.064 46	0.056 90	0.053 08	Log.
Limit	61	61	62	63	64	64	64	64	65	66	66	66	Minutes
Meridian	33°	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 18	0 18	0 17	0 17	0 17	0 17	0 17	0 16	0 16	0 16	0 16	4
8	1 11	1 11	1 10	1 10	1 08	1 08	1 07	1 07	1 06	1 05	1 04	1 04	8
12	2 41	2 39	2 38	2 37	2 34	2 33	2 31	2 30	2 28	2 27	2 25	2 24	12
16	4 47	4 45	4 42	4 39	4 34	4 31	4 29	4 26	4 24	4 21	4 19	4 16	16
20	7 28	7 24	7 20	7 16	7 08	7 04	7 00	6 56	6 52	6 48	6 44	6 40	20
24	10 46	10 40	10 34	10 28	10 16	10 11	10 05	9 59	9 53	9 48	9 42	9 36	24
28	14 38	14 30	14 22	14 15	13 59	13 51	13 43	13 35	13 28	13 20	13 12	13 04	28
32	19 06	18 56	18 46	18 36	18 16	18 05	17 55	17 45	17 35	17 24	17 14	17 04	32
36	24 12	25 59	23 46	23 33	23 07	22 54	22 41	22 28	22 15	22 02	21 49	21 36	36
40	29 52	29 36	29 20	29 04	28 32	28 16	28 00	27 44	27 28	27 12	26 56	26 40	40
44	36 09	35 49	35 30	35 10	34 32	34 12	33 53	33 33	33 14	32 55	32 35	32 16	44
48	43 00	42 37	42 14	41 51	41 05	40 42	40 19	39 56	39 33	39 10	38 47	38 24	48
52	50 28	50 01	49 34	49 07	48 13	47 46	47 19	46 52	46 25	45 58	45 31	45 04	52
56	58 33	58 01	57 30	56 58	55 56	55 24	54 53	54 21	53 50	53 19	52 47	52 16	56
60	67 12	66 36	66 00	65 24	64 12	63 36	63 00	62 24	61 48	61 12	60 36	60 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.12	1.11	1.10	1.09	1.07	1.06	1.05	1.04	1.03	1.02	1.01	1.00	$\triangle_1 h$
Log.	0.049 22	0.045 32	0.041 39	0.037 43	0.029 38	0.025 31	0.021 19	0.017 03	0.012 84	0.008 60	0.004 32	0.00 ...	Log.
Limit	67	68	69	70	70	70	71	72	73	73	74	75	Minutes
Meridian	21°	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	Altitudes

Latitude 57° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 15	0 15	0 15	0 15	...	...	...	...	...	...	...	4
8	1 03	1 02	1 01	1 00	1 00	...	...	...	...	...	...	...	8
12	2 23	2 20	2 19	2 16	2 16	...	...	...	...	...	...	...	12
16	4 13	4 08	4 05	4 03	4 02	...	...	...	...	...	...	...	16
20	6 36	6 28	6 24	6 22	6 20	...	...	...	...	...	...	...	20
24	9 30	9 18	9 13	9 10	9 07	...	...	...	...	...	...	...	24
28	12 57	12 41	12 33	12 29	12 25	...	...	...	...	...	...	...	28
32	16 54	16 34	16 23	16 18	16 13	...	...	...	...	...	...	...	32
36	21 23	20 57	20 44	20 37	20 31	...	...	...	...	...	...	...	36
40	26 24	25 52	25 36	25 28	25 20	...	...	...	...	...	...	...	40
44	31 56	31 18	30 58	30 49	30 39	...	...	...	...	...	...	...	44
48	38 01	37 15	36 52	36 40	36 29	...	...	...	...	...	...	...	48
52	44 37	43 43	43 16	43 02	42 49	...	...	...	...	...	...	...	52
56	51 44	50 42	50 10	49 39	49 39	...	...	...	...	...	...	...	56
60	59 24	58 12	57 36	57 18	57 00	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.99	0.97	0.96	0.955	0.95	...	...	...	...	...	...	...	$\Delta_1 h$
Log.	9.995 64	9.986 77	9.982 27	9.980 00	9.977 72	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	76	77	77	78	79								Minutes
Meridian	9°	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	0 14	0 14	0 13	0 13	0 13	0 12	0 12	0 12	0 12	0 12	4
8	...	...	0 54	0 53	0 52	0 52	0 51	0 51	0 50	0 50	0 49	0 48	8
12	...	...	2 01	1 59	1 58	1 56	1 55	1 54	1 53	1 51	1 50	1 48	12
16	...	...	3 35	3 33	3 30	3 28	3 25	3 22	3 19	3 17	3 14	3 12	16
20	...	...	5 36	5 32	5 28	5 24	5 20	5 16	5 12	5 08	5 04	5 00	20
24	...	...	8 04	7 58	7 53	7 47	7 41	7 35	7 29	7 23	7 18	7 12	24
28	...	...	10 58	10 51	10 43	10 35	10 27	10 20	10 12	10 04	9 56	9 48	28
32	...	...	14 20	14 10	13 59	13 49	13 39	13 29	13 19	13 09	12 58	12 48	32
36	...	...	18 09	17 56	17 43	17 30	17 17	17 04	16 51	16 38	16 25	16 12	36
40	...	...	22 24	22 08	21 52	21 36	21 20	21 04	20 48	20 32	20 16	20 00	40
44	...	...	27 06	26 47	26 28	26 08	25 49	25 29	25 10	24 51	24 31	24 12	44
48	...	...	32 15	31 52	31 29	31 06	30 43	30 18	29 55	29 32	29 09	28 46	48
52	...	...	37 51	37 24	36 57	36 30	36 03	35 36	35 09	34 42	34 15	33 48	52
56	...	...	43 54	43 23	42 52	42 20	41 49	41 17	40 46	40 15	39 44	39 12	56
60	...	...	50 24	49 48	49 12	48 36	48 00	47 24	46 48	46 12	45 36	45 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	0.84	0.83	0.82	0.81	0.80	0.79	0.78	0.77	0.76	0.75	$\Delta_1 h$
Log.	... ...	... ...	9.924 28	9.919 08	9.913 81	9.908 49	9.903 09	9.897 63	9.892 09	9.886 49	9.880 81	9.875 06	Log.
Limit			86	86	86	86	86	86	86	86	86	86	Minutes
Meridian	3°	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	Altitudes

Latitude 57° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 10	0 10	4
8	0 48	0 47	0 46	0 45	0 45	0 44	0 43	0 42	0 41	0 40	0 39	0 39	8
12	1 47	1 45	1 44	1 42	1 41	1 39	1 36	1 35	1 33	1 30	1 29	1 27	12
16	3 09	3 07	3 04	3 02	2 59	2 57	2 52	2 49	2 47	2 42	2 39	2 37	16
20	4 56	4 52	4 48	4 44	4 40	4 36	4 28	4 24	4 20	4 12	4 08	4 04	20
24	7 06	7 00	6 55	6 49	6 43	6 38	6 26	6 21	6 15	6 03	5 58	5 52	24
28	9 40	9 33	9 25	9 17	9 09	9 01	8 45	8 37	8 29	8 14	8 06	7 58	28
32	12 38	12 28	12 17	12 07	11 57	11 46	11 26	11 15	11 05	10 45	10 34	10 24	32
36	15 59	15 46	15 33	15 20	15 07	14 55	14 29	14 16	14 03	13 37	13 04	13 11	36
40	19 44	19 28	19 12	18 56	18 40	18 24	17 52	17 36	17 20	16 48	16 32	16 16	40
44	23 52	23 33	23 14	22 54	22 35	22 16	21 38	21 18	20 59	20 20	20 01	19 41	44
48	28 23	28 00	27 37	27 14	26 51	26 29	25 43	25 20	24 57	24 11	23 48	23 25	48
52	33 21	32 54	32 27	32 00	31 33	31 05	30 11	29 44	29 17	28 23	27 56	27 29	52
56	38 40	38 09	37 38	37 06	36 35	36 04	35 02	34 30	33 59	32 56	32 25	31 53	56
60	44 24	43 48	43 12	42 36	42 00	41 24	40 12	39 36	39 00	37 48	37 12	36 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.74	0.73	0.72	0.71	0.70	0.69	0.67	0.66	0.65	0.63	0.62	0.61	$\Delta_1 h$
Log.	9.869 23	9.863 32	9.857 33	9.851 26	9.845 10	9.838 85	9.826 07	9.819 54	9.812 91	9.799 34	9.792 39	9.785 33	Log.
Limit	86	86	86	86	86	86	86	86	86	86	86	86	Minutes
Meridian	15°	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 10	0 09	0 09	0 09	0 09	0 09	0 09	0 08	0 08	0 07	0 07	0 07	4
8	0 38	0 38	0 37	0 37	0 36	0 35	0 33	0 32	0 31	0 30	0 29	0 29	8
12	1 26	1 25	1 22	1 21	1 19	1 16	1 15	1 12	1 09	1 07	1 05	1 04	12
16	2 34	2 31	2 26	2 23	2 21	2 16	2 13	2 08	2 03	1 57	1 55	1 52	16
20	4 00	3 56	3 48	3 44	3 40	3 32	3 28	3 20	3 12	3 04	3 00	2 56	20
24	5 46	5 40	5 28	5 23	5 17	5 05	5 00	4 48	4 36	4 25	4 19	4 13	24
28	7 50	7 43	7 27	7 19	7 11	6 56	6 48	6 32	6 16	6 01	5 53	5 45	28
32	10 14	10 04	9 44	9 33	9 23	9 03	8 52	8 32	8 12	7 51	7 41	7 31	32
36	12 58	12 45	12 09	12 06	11 53	11 27	11 14	10 48	10 22	9 56	9 43	9 30	36
40	16 00	15 44	15 12	14 56	14 40	14 08	13 52	13 20	12 48	12 16	12 00	11 44	40
44	19 22	19 02	18 24	18 04	17 45	17 06	16 47	16 08	15 29	14 50	14 31	14 11	44
48	23 02	22 39	21 53	21 30	21 07	20 21	19 58	19 12	18 26	17 40	17 17	16 54	48
52	27 02	26 35	25 41	25 14	24 47	23 53	23 26	22 32	21 38	20 44	20 17	19 50	52
56	31 22	30 50	29 48	29 16	28 45	27 42	27 11	26 08	25 05	24 04	23 31	22 59	56
60	36 00	35 24	34 12	33 36	33 00	31 48	31 12	30 00	28 48	27 36	27 00	26 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.60	0.59	0.57	0.56	0.55	0.53	0.52	0.50	0.48	0.46	0.45	0.44	$\Delta_1 h$
Log.	9.778 15	9.770 85	9.755 87	9.748 19	9.740 36	9.724 28	9.716 00	9.698 97	9.681 24	9.662 76	9.653 21	9.643 45	Log.
Limit	86	86	86	86	86	86	86	86	86	86	86	86	Minutes
Meridian	27°	28°	29°	30°	31°	32°	33°	34°	35°	36°	37°	38°	Altitudes

Latitude 58° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 20	0 20	0 20	0 20	0 21	0 21	0 21	0 22	0 22	0 22	0 22	4
8	1 19	1 20	1 20	1 21	1 22	1 23	1 23	1 25	1 26	1 27	1 28	1 30	8
12	2 57	2 59	3 00	3 03	3 05	3 07	3 08	3 11	3 14	3 16	3 19	3 22	12
16	5 15	5 17	5 20	5 25	5 27	5 33	5 36	5 41	5 46	5 48	5 53	5 58	16
20	8 12	8 16	8 20	8 28	8 32	8 40	8 44	8 52	9 00	9 04	9 12	9 20	20
24	11 48	11 54	12 00	12 11	12 17	12 29	12 35	12 46	12 58	13 04	13 15	13 26	24
28	16 05	16 12	16 20	16 36	16 44	16 59	17 07	17 23	17 38	17 46	18 02	18 18	28
32	21 00	21 10	21 20	21 41	21 51	22 11	22 21	22 42	23 02	23 12	23 33	23 54	32
36	26 34	26 47	27 00	27 26	27 39	28 05	28 18	28 44	29 10	29 23	29 49	30 14	36
40	32 48	33 04	33 20	33 52	34 08	34 40	34 56	35 28	36 00	36 16	36 48	37 20	40
44	39 41	40 00	40 20	40 59	41 18	41 57	42 16	42 55	43 34	43 53	44 32	45 10	44
48	47 14	47 37	48 00	48 46	49 09	49 55	50 18	51 04	51 50	52 13	52 59	53 46	48
52	55 26	55 53	56 20	57 14	57 41	58 35	59 02	59 56	60 50	61 17	62 11	63 06	52
56	64 17	64 48	65 20	66 23	66 54	67 57	68 28	69 31	70 34	71 05	72 08	73 10	56
60	73 48	74 24	75 00	76 12	76 48	78 00	78 36	79 48	81 00	81 36	82 48	84 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.23	1.24	1.25	1.27	1.28	1.30	1.31	1.33	1.35	1.36	1.38	1.40	$\Delta_1 h$
Log.	0.089 91	0.093 42	0.096 91	0.103 80	0.107 21	0.113 94	0.117 27	0.123 85	0.130 33	0.133 54	0.139 88	0.146 13	Log.
Limit	62	62	61	60	59	59	58	57	57	56	56	55	Minutes
Meridian	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 23	0 23	0 23	0 24	0 25	0 25	0 25	0 26	0 27	0 27	4
8	1 30	1 32	1 33	1 34	1 36	1 37	1 39	1 40	1 42	1 42	1 45	1 47	8
12	3 23	3 24	3 29	3 32	3 35	3 39	3 42	3 45	3 49	3 51	3 56	4 00	12
16	6 01	6 06	6 11	6 16	6 21	6 29	6 34	6 39	6 47	6 53	7 00	7 08	16
20	9 24	9 32	9 40	9 48	9 56	10 08	10 16	10 24	10 36	10 44	10 56	11 08	20
24	13 32	13 43	13 55	14 06	14 18	14 36	14 47	14 59	15 16	15 28	15 45	16 02	24
28	18 26	18 42	18 57	19 13	19 29	19 52	20 07	20 23	20 47	21 02	21 25	21 49	28
32	24 04	24 25	24 45	25 06	25 26	25 56	26 17	26 37	27 08	27 28	27 59	28 30	32
36	30 27	30 53	31 19	31 45	32 11	32 50	33 16	33 42	34 21	34 47	35 26	36 05	36
40	37 36	38 08	38 40	39 12	39 44	40 32	41 04	41 36	42 24	42 56	43 44	44 32	40
44	45 29	46 08	46 47	47 26	48 04	49 03	49 41	50 20	51 18	51 57	52 55	53 54	44
48	54 09	54 55	55 41	56 27	57 13	58 22	59 08	59 54	61 03	61 49	62 58	64 07	48
52	63 33	64 27	65 21	66 15	67 09	68 30	69 24	70 18	71 39	72 33	73 54	75 15	52
56	73 41	74 44	75 37	76 50	77 52	79 27	80 29	81 32	83 06	84 09	85 43	87 18	56
60	84 36	85 48	87 00	88 12	89 24	91 12	92 24	93 36	95 24	96 36	98 24	100 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.41	1.43	1.45	1.47	1.49	1.52	1.54	1.56	1.59	1.61	1.64	1.67	$\Delta_1 h$
Log.	0.149 22	0.155 34	0.161 37	0.167 32	0.173 19	0.181 84	0.187 52	0.193 12	0.201 40	0.206 83	0.214 84	0.222 72	Log.
Limit	55	54	53	53	52	51	51	50	50	49	48	47	Minutes
Meridian	44°	45°	46°	47°	48°	49°	50°	51°	52°	53°	54°	55°	Altitudes

Latitude 58° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 27	0 28	0 28	0 30	0 30	0 31	0 31	0 32	0 33	0 34	0 35	4
8	1 49	1 51	1 53	1 55	1 58	2 00	2 02	2 05	2 09	2 12	2 15	2 19	8
12	4 05	4 09	4 14	4 19	4 25	4 31	4 37	4 43	4 49	4 58	5 06	5 14	12
16	7 15	7 23	7 30	7 41	7 51	8 01	8 11	8 21	8 35	8 46	9 02	9 18	16
20	11 20	11 32	11 44	12 00	12 16	12 32	12 48	13 24	13 24	13 44	14 08	14 32	20
24	16 19	16 36	16 54	17 17	17 40	18 03	18 26	18 49	19 18	19 46	20 21	20 56	24
28	22 13	22 37	23 00	23 31	24 02	24 34	25 06	25 37	26 16	26 55	27 41	28 29	28
32	29 01	29 32	30 03	30 43	31 24	32 05	32 46	33 27	34 18	35 10	36 10	37 12	32
36	36 43	37 22	38 01	38 53	39 45	40 37	41 28	42 20	43 25	44 30	45 58	47 06	36
40	45 20	46 08	46 56	48 00	49 04	50 08	51 12	52 16	53 36	54 56	56 32	58 08	40
44	54 51	55 49	56 47	58 05	59 22	60 40	61 57	63 14	64 51	66 28	68 25	70 21	44
48	65 15	66 24	67 33	69 07	70 39	72 11	73 44	75 16	77 11	79 06	...	...	48
52	76 37	77 58	79 19	81 07	82 55	84 43	86 32	...	...	...	...	...	52
56	88 51	90 25	91 59	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.70	1.73	1.76	1.80	1.84	1.88	1.92	1.96	2.01	2.06	2.12	2.18	$\triangle_1$h
Log.	0.230 45	0.238 05	0.245 51	0.255 27	0.264 82	0.274 16	0.283 30	0.292 26	0.303 20	0.313 87	0.326 34	0.338 46	Log.
Limit	46	46	45	44	43	42	42	41	40	39	38	37	Minutes
Meridian	56°	57°	58°	59°	60°	61°	62°	63°	64°	65°	66°	67°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 36	0 38	0 39	0 40	0 41	0 44	0 45	0 47	0 49	0 52	0 56	1 00	4
8	2 25	2 28	2 33	2 39	2 45	2 51	2 59	3 09	3 18	3 29	3 44	3 58	8
12	5 24	5 35	5 45	5 57	6 12	6 27	6 43	7 04	7 25	7 50	8 22	8 55	12
16	9 36	9 52	10 15	10 35	11 00	11 25	11 56	12 32	13 10	13 56	14 50	15 52	16
20	15 00	15 28	16 00	16 32	17 12	17 52	18 39	19 37	20 36	21 48	23 13	24 48	20
24	21 36	22 16	23 03	23 48	24 46	25 44	26 53	28 15	29 40	31 23	33 25	35 43	24
28	29 24	30 18	31 21	32 25	33 43	35 02	36 35	38 26	40 23	42 44	45 28	48 37	28
32	38 24	39 36	40 57	42 20	44 02	45 44	47 47	50 11	52 44	55 49	59 24	63 29	32
36	48 36	50 07	51 50	53 34	55 44	57 54	60 29	63 00	66 45	...	...	...	36
40	60 00	61 52	64 00	66 08	68 48	71 28	...	...	...	...	...	...	40
44	72 36	74 52	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	2.25	2.32	2.40	2.48	2.58	2.68	2.80	2.94	3.09	3.27	3.48	3.72	$\triangle_1$h
Log.	0.352 18	0.365 49	0.380 21	0.394 45	0.411 62	0.428 13	0.447 16	0.468 35	0.489 96	0.514 55	0.541 58	0.570 54	Log.
Limit	37	36	35	34	33	32	31	30	29	28	26	25	Minutes
Meridian	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	79°	Altitudes

Latitude 58° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 04	1 10	1 17	1 26	1 38	1 55	...	...	...	...	...	...	4
8	4 16	4 39	5 08	5 45	6 33	7 40	...	...	...	...	...	...	8
12	9 37	10 29	11 32	12 53	14 43	17 15	...	...	...	...	...	...	12
16	17 06	18 37	20 32	22 55	26 10	30 41	...	...	...	...	...	...	16
20	26 44	29 04	32 04	35 48	40 52	47 56	...	...	...	...	...	...	20
24	38 30	41 52	46 11	51 33	...	...	...	...	...	...	...	...	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	4.01	4.36	4.81	5.37	6.13	7.19	...	...	...	...	...	...	$\triangle_1 h$
Log.	0.603 14	0.639 49	0.682 15	0.729 97	0.787 46	0.856 73	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	22	21	20	19	17	15	12	10	8	3	0	3	Minutes
Meridian	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	89°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	1 27	1 10	1 00	0 48	0 42	0 36	0 31	0 27	0 23	4
8	...	...	...	5 47	4 39	3 51	3 15	2 46	2 24	2 05	1 50	1 34	8
12	...	...	...	13 00	10 29	8 40	7 18	6 14	5 22	4 41	4 07	3 32	12
16	...	...	...	23 06	18 37	15 24	12 59	11 06	9 33	8 20	7 19	6 16	16
20	...	...	...	36 08	29 04	24 03	20 16	17 19	14 55	13 01	11 25	9 48	20
24	...	...	...	...	...	34 39	29 11	24 58	21 30	18 44	16 27	14 06	24
28	...	...	...	...	...	...	39 42	33 58	29 16	25 29	22 23	19 13	28
32	...	...	...	...	...	...	...	44 22	38 14	33 17	29 11	25 06	32
36	...	...	...	...	...	...	...	...	48 23	42 06	36 57	31 45	36
40	...	...	...	...	...	...	...	...	...	52 00	45 36	39 12	40
44	...	...	...	...	...	...	...	...	...	...	55 10	47 26	44
48	...	...	...	...	...	...	...	...	...	...	...	56 27	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	5.42	4.36	3.61	3.04	2.60	2.24	1.95	1.71	1.47	$\triangle_1 h$
Log.	... ...	... ...	... ...	0.734 00	0.639 49	0.557 51	0.482 87	0.414 97	0.350 25	0.290 03	0.233 00	0.167 32	Log.
Limit	6	9	12	15	18	20	23	26	29	32	36	40	Minutes
Meridian	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	77°	Altitudes

Latitude 58° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 18	0 18	0 18	0 17	4
8	1 19	1 17	1 17	1 16	1 15	1 14	1 13	1 13	1 12	1 11	1 11	1 10	8
12	2 57	2 54	2 53	2 51	2 50	2 47	2 45	2 44	2 42	2 41	2 39	2 37	12
16	5 15	5 10	5 07	5 05	5 02	4 57	4 55	4 52	4 50	4 47	4 45	4 39	16
20	8 12	8 04	8 00	7 56	7 52	7 44	7 40	7 36	7 32	7 28	7 24	7 16	20
24	11 48	11 37	11 31	11 26	11 20	11 09	11 03	10 57	10 51	10 46	10 40	10 28	24
28	16 05	15 49	15 41	15 33	15 25	15 09	15 01	14 53	14 46	14 38	14 30	14 15	28
32	21 00	20 39	20 29	20 18	20 08	19 47	19 37	19 27	19 17	19 06	18 56	18 36	32
36	26 34	26 08	25 55	25 43	25 30	25 04	24 51	24 38	24 25	24 12	23 59	23 33	36
40	32 48	32 16	32 00	31 44	31 28	30 56	30 40	30 24	30 08	29 52	29 36	29 04	40
44	39 41	39 02	38 43	38 24	38 05	37 26	37 07	36 47	36 28	36 09	35 49	35 10	44
48	47 14	46 28	46 05	45 41	45 18	44 32	44 09	43 46	43 23	43 00	42 37	41 51	48
52	55 26	54 32	54 05	53 37	53 10	52 16	51 49	51 22	50 55	50 28	50 01	49 07	52
56	64 17	63 14	62 43	62 12	61 41	60 38	60 07	59 35	39 04	58 33	58 01	56 58	56
60	73 48	72 36	72 00	71 24	70 48	69 36	69 00	68 24	67 48	67 12	66 36	65 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.23	1.21	1.20	1.19	1.18	1.16	1.15	1.14	1.13	1.12	1.11	1.09	$\Delta_1 h$
Log.	0.089 91	0.082 79	0.079 18	0.075 55	0.071 88	0.064 46	0.060 70	0.056 90	0.053 08	0.049 22	0.045 32	0.037 43	Log.
Limit	62	63	64	64	65	65	65	66	66	67	68	68	Minutes
Meridian	32°	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 17	0 17	0 17	0 16	0 16	0 16	0 16	0 15	0 15	0 15	4
8	1 09	1 08	1 08	1 07	1 07	1 06	1 05	1 04	1 04	1 03	1 02	1 02	8
12	2 36	2 34	2 33	2 31	2 30	2 28	2 27	2 25	2 24	2 23	2 22	2 20	12
16	4 36	4 34	4 31	4 29	4 26	4 24	4 21	4 19	4 16	4 13	4 10	4 08	16
20	7 12	7 08	7 04	7 00	6 56	6 52	6 48	6 44	6 40	6 36	6 32	6 28	20
24	10 22	10 16	10 11	10 05	9 59	9 53	9 48	9 42	9 36	9 30	9 24	9 18	24
28	14 07	13 59	13 51	13 43	13 35	13 28	13 20	13 12	13 04	12 57	12 49	12 41	28
32	18 26	18 16	18 05	17 55	17 45	17 35	17 24	17 14	17 04	16 54	16 44	16 34	32
36	23 20	23 07	22 54	22 41	22 28	22 15	22 02	21 49	21 36	21 23	21 10	20 57	36
40	28 48	28 32	28 16	28 00	27 44	27 28	27 12	26 56	26 40	26 24	26 08	25 52	40
44	34 51	34 32	34 12	33 53	33 33	33 14	32 55	32 35	32 16	31 56	31 37	31 18	44
48	41 28	41 05	40 42	40 19	39 56	39 33	39 10	38 47	38 24	38 10	37 38	37 15	48
52	48 40	48 13	47 46	47 19	46 52	46 25	45 58	45 31	45 04	44 37	44 10	43 43	52
56	56 27	55 56	55 24	54 53	54 21	53 50	53 19	52 47	52 16	51 44	51 13	50 42	56
60	64 48	64 12	63 36	63 00	62 24	61 48	61 12	60 36	60 00	59 24	58 48	58 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.08	1.07	1.06	1.05	1.04	1.03	1.02	1.01	1.00	0.99	0.98	0.97	$\Delta_1 h$
Log.	0.033 42	0.029 38	0.025 31	0.021 19	0.017 03	0.012 84	0.008 60	0.004 32	0.000 . . .	9.995 64	9.991 23	9.986 77	Log.
Limit	69	70	71	71	71	71	72	73	74	75	76	77	Minutes
Meridian	20°	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	Altitudes

Latitude 58° Declination Contrary Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 15	0 15	0 14	...	...	...	...	...	...	...	...	4
8	1 01	1 00	1 00	0 59	...	...	...	...	...	...	...	...	8
12	2 19	2 16	2 14	2 13	...	...	...	...	...	...	...	...	12
16	4 05	4 02	4 00	3 57	...	...	...	...	...	...	...	...	16
20	6 24	6 20	6 16	6 12	...	...	...	...	...	...	...	...	20
24	9 13	9 07	9 01	8 56	...	...	...	...	...	...	...	...	24
28	12 33	12 25	12 17	12 09	...	...	...	...	...	...	...	...	28
32	16 23	16 13	16 03	15 52	...	...	...	...	...	...	...	...	32
36	20 44	20 31	20 18	20 05	...	...	...	...	...	...	...	...	36
40	25 36	25 20	25 04	24 48	...	...	...	...	...	...	...	...	40
44	30 58	30 39	30 19	30 00	...	...	...	...	...	...	...	...	44
48	36 52	36 29	36 06	35 43	...	...	...	...	...	...	...	...	48
52	43 16	42 49	42 22	41 55	...	...	...	...	...	...	...	...	52
56	50 10	49 39	49 07	48 36	...	...	...	...	...	...	...	...	56
60	57 36	57 00	56 24	55 48	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.96	0.95	0.94	0.93	...	...	...	...	...	...	...	...	$\triangle_1$h
Log.	9.982 27	9.977 72	9.973 13	9.968 48	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	78	78	79	80									Minutes
Meridian	8°	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	0 14	0 13	0 13	0 13	0 12	0 12	0 12	0 12	0 12	0 12	0 12	4
8	...	0 53	0 52	0 52	0 51	0 51	0 50	0 50	0 49	0 49	0 48	0 48	8
12	...	1 59	1 58	1 56	1 55	1 54	1 53	1 51	1 50	1 49	1 48	1 47	12
16	...	3 33	3 30	3 28	3 25	3 22	3 19	3 17	3 14	3 13	3 12	3 09	16
20	...	5 32	5 28	5 24	5 20	5 16	5 12	5 08	5 04	5 02	5 00	4 56	20
24	...	7 58	7 53	7 47	7 41	7 35	7 29	7 23	7 18	7 15	7 12	7 06	24
28	...	10 51	10 43	10 35	10 27	10 20	10 12	10 04	9 56	9 52	9 48	9 40	28
32	...	14 10	13 59	13 49	13 39	13 29	13 19	13 09	12 58	12 53	12 48	12 38	32
36	...	17 56	17 43	17 30	17 17	17 04	16 51	16 38	16 25	16 18	16 12	15 59	36
40	...	22 08	21 52	21 36	21 20	21 04	20 48	20 32	20 16	20 08	20 00	19 44	40
44	...	26 47	26 28	26 08	25 49	25 29	25 10	24 51	24 31	24 21	24 12	23 52	44
48	...	31 52	31 29	31 06	30 43	30 18	29 55	29 32	29 09	28 55	28 46	28 23	48
52	...	37 24	36 57	36 30	36 03	35 36	35 09	34 42	34 15	34 02	33 48	33 21	52
56	...	43 23	42 52	42 20	41 49	41 17	40 46	40 15	39 44	39 28	39 12	38 40	56
60	...	49 48	49 12	48 36	48 00	47 24	46 48	46 12	45 36	45 18	45 00	44 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	0.83	0.82	0.81	0.80	0.79	0.78	0.77	0.76	0.755	0.75	0.74	$\triangle_1$h
Log.	... ...	9.919 08	9.913 81	9.908 49	9.903 09	9.897 63	9.892 09	9.886 49	9.880 81	9.877 95	9.875 06	9.869 23	Log.
Limit		89	89	89	89	89	89	89	89	89	89	89	Minutes
Meridian	4°	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 10	0 10	0 10	4
8	0 47	0 46	0 46	0 45	0 44	0 43	0 42	0 41	0 41	0 40	0 39	0 38	8
12	1 45	1 44	1 42	1 41	1 39	1 36	1 35	1 33	1 30	1 29	1 27	1 26	12
16	3 07	3 04	3 02	2 59	2 57	2 52	2 49	2 47	2 42	2 39	2 37	2 34	16
20	4 52	4 48	4 44	4 40	4 36	4 28	4 24	4 20	4 12	4 08	4 04	4 00	20
24	7 00	6 55	6 49	6 43	6 38	6 26	6 21	6 15	6 03	5 58	5 52	5 46	24
28	9 33	9 25	9 17	9 09	9 01	8 45	8 37	8 29	8 14	8 06	7 58	7 50	28
32	12 28	12 17	12 07	11 57	11 46	11 26	11 15	11 05	10 45	10 34	10 24	10 14	32
36	15 46	15 33	15 30	15 07	14 55	14 29	14 16	14 03	13 37	13 24	13 11	12 58	36
40	19 28	19 12	18 56	18 40	18 24	17 52	17 36	17 20	16 48	16 32	16 16	16 00	40
44	23 33	23 14	22 54	22 35	22 16	21 38	21 18	20 59	20 20	20 01	19 41	19 22	44
48	28 00	27 37	27 14	26 51	26 29	25 43	25 20	24 57	24 11	23 48	23 25	23 02	48
52	32 54	32 27	32 00	31 33	31 05	30 11	29 44	29 17	28 23	27 56	27 29	27 02	52
56	38 09	37 38	37 06	36 35	36 04	35 02	34 30	33 59	32 56	32 25	31 53	31 22	56
60	43 48	43 12	42 36	42 00	41 24	40 12	39 36	39 00	37 48	37 12	36 36	36 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.73	0.72	0.71	0.70	0.69	0.67	0.66	0.65	0.63	0.62	0.61	0.60	$\triangle_1 h$
Log.	9.863 32	9.857 33	9.851 26	9.845 10	9.838 85	9.826 07	9.819 54	9.812 91	9.799 34	9.792 39	9.785 33	9.778 15	Log.
Limit	89	89	89	89	89	89	89	89	89	89	89	89	Minutes
Meridian	16°	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 09	0 09	0 09	0 09	0 09	0 09	0 08	0 08	0 08	0 07	0 07	0 07	4
8	0 38	0 38	0 37	0 36	0 35	0 33	0 32	0 31	0 31	0 30	0 29	0 29	8
12	1 25	1 24	1 22	1 19	1 18	1 15	1 13	1 11	1 09	1 07	1 05	1 04	12
16	2 31	2 28	2 26	2 21	2 18	2 13	2 11	2 05	2 03	1 57	1 55	1 52	16
20	3 56	3 52	3 48	3 40	3 36	3 28	3 24	3 16	3 12	3 04	3 00	2 56	20
24	5 40	5 34	5 28	5 17	5 11	5 00	4 54	4 42	4 36	4 25	4 19	4 13	24
28	7 43	7 35	7 27	7 11	7 03	6 48	6 40	6 25	6 16	6 01	5 53	5 45	28
32	10 04	9 54	9 44	9 23	9 13	8 52	8 42	8 22	8 12	7 51	7 41	7 31	32
36	12 45	12 32	12 19	11 53	11 40	11 14	11 01	10 35	10 22	9 56	9 43	9 30	36
40	15 44	15 28	15 12	14 40	14 24	13 52	13 36	13 04	12 48	12 16	12 00	11 44	40
44	19 02	18 43	18 24	17 45	17 25	16 47	16 27	15 48	15 29	14 50	14 31	14 11	44
48	22 39	22 16	21 53	21 07	20 44	19 58	19 35	18 49	18 26	17 40	17 17	16 54	48
52	26 35	26 08	25 41	24 47	24 20	23 26	22 59	22 05	21 38	20 44	20 17	19 50	52
56	30 50	30 19	29 48	28 45	28 13	27 11	26 39	25 36	25 05	24 04	23 31	22 59	56
60	35 24	34 48	34 12	33 00	32 24	31 12	30 36	29 24	28 48	27 36	27 00	26 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.59	0.58	0.57	0.55	0.54	0.52	0.51	0.49	0.48	0.46	0.45	0.44	$\triangle_1 h$
Log.	9.770 85	9.763 43	9.755 87	9.740 36	7.732 39	9.716 00	9.707 57	9.690 20	9.681 24	9.662 76	9.653 21	9.643 45	Log.
Limit	89	89	89	89	89	89	89	89	89	89	89	89	Minutes
Meridian	28°	29°	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	Altitudes

Latitude 59° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 19	0 19	0 20	0 20	0 20	0 20	0 21	0 21	0 22	4
8	1 15	1 16	1 17	1 18	1 19	1 20	1 21	1 21	1 23	1 23	1 24	1 26	8
12	2 50	2 51	2 54	2 56	2 57	3 00	3 02	3 03	3 06	3 07	3 10	3 13	12
16	5 02	5 05	5 10	5 12	5 15	5 20	5 22	5 25	5 30	5 33	5 38	5 43	16
20	7 52	7 56	8 04	8 08	8 12	8 20	8 24	8 28	8 36	8 40	8 48	8 56	20
24	11 20	11 26	11 37	11 43	11 48	12 00	12 06	12 11	12 23	12 29	12 41	12 52	24
28	15 25	15 33	15 49	15 57	16 05	16 20	16 28	16 36	16 52	16 59	17 15	17 30	28
32	20 08	20 18	20 39	20 49	21 00	21 20	21 30	21 41	22 01	22 11	22 31	22 52	32
36	25 30	25 43	26 08	26 21	26 34	27 00	27 13	27 26	27 52	28 05	28 31	28 57	36
40	31 28	31 44	32 16	32 32	32 48	33 20	33 36	33 52	34 24	34 40	35 12	35 44	40
44	38 05	38 24	39 02	39 22	39 41	40 20	40 39	40 59	41 37	41 57	42 36	43 14	44
48	45 18	45 41	46 28	46 51	47 14	48 00	48 23	48 46	49 32	49 55	50 41	51 17	48
52	53 10	53 37	54 32	54 59	55 26	56 20	56 47	57 14	58 08	58 35	59 29	60 23	52
56	61 41	62 12	63 14	63 46	64 17	65 20	65 51	66 23	67 25	67 57	69 00	70 02	56
60	70 48	71 24	72 36	73 12	73 48	75 00	75 36	76 12	77 24	78 00	79 12	80 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.18	1.19	1.21	1.22	1.23	1.25	1.26	1.27	1.29	1.30	1.32	1.34	$\triangle_1$h
Log.	0.071 88	0.075 55	0.082 79	0.086 36	0.089 91	0.096 91	0.100 37	0.103 80	0.100 59	0.113 94	0.120 57	0.127 10	Log.
Limit	64	64	63	62	61	60	60	59	59	58	58	57	Minutes
Meridian	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 22	0 22	0 23	0 23	0 23	0 24	0 24	0 25	0 25	4
8	1 26	1 28	1 29	1 30	1 32	1 33	1 34	1 36	1 36	1 38	1 40	1 41	8
12	3 14	3 17	3 20	3 23	3 24	3 29	3 32	3 35	3 37	3 40	3 45	3 48	12
16	5 46	5 51	5 56	6 01	6 06	6 11	6 16	6 21	6 27	6 32	6 39	6 44	16
20	9 00	9 08	9 16	9 24	9 32	9 40	9 48	9 56	10 04	10 12	10 24	10 32	20
24	12 58	13 09	13 21	13 32	13 43	13 55	14 06	14 18	14 30	14 41	14 59	15 10	24
28	17 38	17 54	18 10	18 26	18 42	18 57	19 13	19 29	19 44	20 00	20 23	20 39	28
32	23 02	23 23	23 43	24 04	24 25	24 45	25 06	25 26	25 46	26 07	26 37	26 58	32
36	29 10	29 36	30 02	30 27	30 53	31 19	31 45	32 11	32 37	33 03	33 42	34 08	36
40	36 00	36 32	37 04	37 36	38 08	38 40	39 12	39 44	40 16	40 48	41 36	42 08	40
44	43 34	44 13	44 51	45 29	46 08	46 47	47 26	48 04	48 43	49 22	50 20	50 59	44
48	51 50	52 36	53 22	54 09	54 55	55 41	56 27	57 13	57 59	58 45	59 54	60 40	48
52	60 50	61 44	62 38	66 33	64 27	65 21	66 15	67 09	68 03	68 57	70 18	71 12	52
56	70 34	71 37	72 39	73 41	74 44	75 37	76 50	77 52	78 55	79 58	81 32	82 25	56
60	81 00	82 12	83 24	84 36	85 48	87 00	88 12	89 24	90 36	91 48	93 36	94 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.35	1.37	1.39	1.41	1.43	1.45	1.47	1.49	1.51	1.53	1.56	1.58	$\triangle_1$h
Log.	0.130 33	0.136 72	0.143 01	0.149 22	0.155 34	0.161 37	0.167 32	0.173 19	0.178 98	0.184 69	0.193 12	0.198 66	Log.
Limit	56	56	55	55	54	53	53	52	52	51	50	49	Minutes
Meridian	43°	44°	45°	46°	47°	48°	49°	50°	51°	52°	53°	54°	Altitudes

Latitude 59° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 26	0 26	0 27	0 27	0 28	0 29	0 29	0 30	0 30	0 31	0 32	0 33	4
8	1 43	1 44	1 47	1 49	1 51	1 54	1 56	1 58	2 01	2 03	2 06	2 11	8
12	3 51	3 54	4 00	4 05	4 09	4 15	4 20	4 26	4 32	4 38	4 46	4 54	12
16	6 53	6 58	7 08	7 15	7 23	7 33	7 44	7 54	8 04	8 14	8 26	8 42	16
20	10 44	10 52	11 08	11 20	11 32	11 48	12 04	12 20	12 36	12 52	13 12	13 36	20
24	15 28	15 39	16 02	16 19	16 36	16 59	17 23	17 46	18 09	18 31	19 00	19 35	24
28	21 02	21 18	21 49	22 16	22 37	23 08	23 39	24 10	24 42	25 14	25 53	26 39	28
32	27 28	27 49	28 30	29 32	29 32	30 13	30 53	31 34	32 15	32 57	33 48	34 49	32
36	34 47	35 13	36 05	36 43	37 22	38 14	39 06	39 58	40 50	41 41	42 46	44 04	36
40	42 56	43 28	44 32	45 20	46 08	47 12	48 16	49 20	50 24	51 28	52 48	54 24	40
44	51 57	52 36	53 54	54 51	55 49	57 07	58 24	59 42	60 59	62 16	63 53	65 49	44
48	61 49	62 35	64 07	65 15	66 24	67 56	69 30	71 02	72 34	74 07	76 02	78 20	48
52	72 33	73 27	75 15	76 37	77 58	79 46	81 34	83 22	...	...	...	...	52
56	84 09	85 12	87 18	88 51	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.61	1.63	1.67	1.70	1.73	1.77	1.81	1.85	1.89	1.93	1.98	2.04	$\triangle_1 h$
Log.	0.206 83	0.212 19	0.222 72	0.230 45	0.238 05	0.247 97	0.257 68	0.267 17	0.276 46	0.285 56	0.296 67	0.309 63	Log.
Limit	48	48	47	46	45	44	43	43	42	41	40	39	Minutes
Meridian	55°	56°	57°	58°	59°	60°	61°	62°	63°	64°	65°	66°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 33	0 34	0 36	0 37	0 38	0 39	0 41	0 44	0 46	0 48	0 50	0 54	4
8	2 14	2 18	2 22	2 27	2 32	2 38	2 45	2 53	3 00	3 10	3 20	3 33	8
12	5 01	5 10	5 20	5 31	5 43	5 55	6 11	6 27	6 45	7 07	7 29	8 00	12
16	8 55	9 12	9 29	9 48	10 10	10 32	11 00	11 25	12 00	12 38	13 18	14 10	16
20	13 56	14 23	14 49	15 19	15 53	16 27	17 12	17 52	18 45	19 45	20 46	22 08	20
24	20 04	20 45	21 20	22 05	22 52	23 41	24 45	25 44	27 00	28 26	29 58	31 52	24
28	27 19	28 13	29 01	30 03	31 05	32 17	33 43	35 02	36 43	38 41	40 46	43 20	28
32	35 40	36 51	37 53	39 15	40 38	42 10	44 02	45 44	47 57	50 31	53 14	56 39	32
36	45 09	46 41	47 56	49 41	51 25	53 21	55 44	57 54	60 42	63 56	...	...	36
40	55 44	57 36	59 12	61 20	63 28	65 52	68 48	71 28	...	...	...	...	40
44	67 26	69 42	71 38	74 13	76 48	...	...	...	...	...	...	...	44
48	80 15	82 56	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.09	2.16	2.22	2.30	2.38	2.47	2.58	2.68	2.81	2.96	3.12	3.32	$\triangle_1 h$
Log.	0.320 15	0.334 45	0.346 35	0.361 73	0.376 58	0.392 70	0.411 62	0.428 13	0.448 71	0.471 29	0.494 15	0.521 14	Log.
Limit	39	38	37	36	35	34	33	32	31	30	28	27	Minutes
Meridian	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	78°	Altitudes

Latitude 59° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 57	1 01	1 07	1 13	1 22	1 34	1 49	...	...	...	...	...	4
8	3 48	4 04	4 26	4 52	5 27	6 16	7 16	...	...	...	...	...	8
12	8 32	9 10	8 00	10 57	12 16	14 06	16 22	...	...	...	...	...	12
16	15 11	16 17	17 45	19 30	21 49	25 04	29 06	...	...	...	...	...	16
20	23 40	25 28	27 44	30 28	34 05	39 12	45 28	...	...	...	...	...	20
24	34 05	36 41	39 56	43 52	49 04	...	...	...	...	...	...	...	24
28	46 23	49 55	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	3.55	3.82	4.16	4.57	5.11	5.88	6.82	...	...	...	...	...	$\triangle_1 h$
Log.	0.550 23	0.582 06	0.619 09	0.659 92	0.708 42	0.769 38	0.833 78	... ...	... ...	... ...	... ...	... ...	Log.
Limit	24	23	22	21	20	18	15	12	9	6	3	0	Minutes
Meridian	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	90°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	1 20	1 05	0 55	0 45	0 39	0 33	0 29	0 24	4
8	...	...	...	...	5 25	4 22	3 36	3 02	2 35	2 14	1 56	1 38	8
12	...	...	...	...	12 13	9 49	8 06	6 50	5 49	5 01	4 20	3 40	12
16	...	...	...	...	21 43	17 26	14 23	12 06	10 20	8 55	7 44	6 32	16
20	...	...	...	...	33 56	27 16	22 28	18 56	16 08	13 56	12 04	10 12	20
24	...	...	...	...	...	...	32 21	27 16	23 14	20 04	17 23	14 41	24
28	...	...	...	...	...	...	...	37 06	31 38	27 19	23 39	20 00	28
32	...	...	...	...	...	...	...	...	41 18	35 40	30 53	26 07	32
36	...	...	...	...	...	...	...	...	...	45 09	39 06	33 03	36
40	...	...	...	...	...	...	...	...	...	...	48 16	40 48	40
44	...	...	...	...	...	...	...	...	...	...	...	49 22	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	5.09	4.09	3.37	2.84	2.42	2.09	1.81	1.53	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	0.706 72	0.611 72	0.527 63	0.453 32	0.383 82	0.320 15	0.257 68	0.184 69	Log.
Limit	3	6	9	12	15	18	22	25	28	31	34	36	Minutes
Meridian	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	78°	Altitudes

Latitude 59° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 19	0 18	0 18	0 18	0 18	0 17	0 17	0 17	0 17	4
8	1 15	1 15	1 14	1 13	1 12	1 11	1 11	1 10	1 10	1 09	1 08	1 08	8
12	2 50	2 48	2 47	2 44	2 42	2 41	2 39	2 38	2 37	2 36	2 34	2 33	12
16	5 02	5 00	4 57	4 52	4 50	4 47	4 45	4 42	4 39	4 36	4 34	4 31	16
20	7 52	7 48	7 44	7 36	7 32	7 28	7 24	7 20	7 16	7 12	7 08	7 04	20
24	11 20	11 14	11 09	10 57	10 51	10 46	10 40	10 34	10 28	10 22	10 16	10 11	24
28	15 25	15 17	15 09	14 53	14 46	14 38	14 30	14 22	14 15	14 07	13 59	13 51	28
32	20 08	19 58	19 47	19 27	19 17	19 06	18 56	18 46	18 36	18 26	18 16	18 05	32
36	25 30	25 17	25 04	24 38	24 25	24 12	23 59	23 46	23 33	23 30	23 07	22 54	36
40	31 28	31 12	30 56	30 24	30 08	29 52	29 36	29 20	29 04	28 48	28 32	28 16	40
44	38 05	37 46	37 26	36 47	36 28	36 09	35 49	35 30	35 10	34 51	34 32	34 12	44
48	45 18	44 55	44 32	43 46	43 23	43 00	42 37	42 14	41 51	41 28	41 05	40 42	48
52	53 10	52 43	52 16	51 22	50 55	50 28	50 01	49 34	49 07	48 40	48 13	47 46	52
56	61 41	61 10	60 38	59 35	59 04	58 33	58 01	57 30	56 58	56 27	55 56	55 24	56
60	70 48	70 12	69 36	68 24	67 48	67 12	66 36	66 00	65 24	64 48	64 12	63 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.18	1.17	1.16	1.14	1.13	1.12	1.11	1.10	1.09	1.08	1.07	1.06	$\triangle_1 h$
Log.	0.071 88	0.068 19	0.064 46	0.056 90	0.053 08	0.049 22	0.045 32	0.041 39	0.037 43	0.033 42	0.029 38	0.025 31	Log.
Limit	64	64	65	65	66	67	67	67	68	68	69	69	Minutes
Meridian	31°	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 16	0 16	0 16	0 16	0 15	0 15	0 15	0 15	0 15	0 15	4
8	1 07	1 07	1 06	1 05	1 04	1 04	1 03	1 02	1 02	1 01	1 01	1 00	8
12	2 31	2 30	2 28	2 27	2 25	2 24	2 33	2 22	2 20	2 19	2 17	2 16	12
16	4 29	4 26	4 24	4 21	4 19	4 16	4 13	4 10	4 08	4 05	4 03	4 00	16
20	7 00	6 56	6 52	6 48	6 44	6 40	6 36	6 32	6 28	6 24	6 20	6 16	20
24	10 05	9 59	9 53	9 48	9 42	9 36	9 30	9 24	9 18	9 13	9 07	9 01	24
28	13 43	13 35	13 28	13 20	13 12	13 04	12 57	12 49	12 41	12 33	12 25	12 17	28
32	17 55	17 45	17 35	17 24	17 14	17 04	16 54	16 44	16 34	16 23	16 13	16 03	32
36	22 41	22 28	22 15	22 02	21 49	21 36	21 23	21 10	20 57	20 44	20 31	20 18	36
40	28 00	27 44	27 28	27 12	26 56	26 40	26 24	26 08	25 52	25 36	25 20	25 04	40
44	33 53	33 33	33 14	32 55	32 35	32 16	31 56	31 37	31 18	30 58	30 39	30 19	44
48	40 19	39 56	39 33	39 10	38 47	38 24	38 01	37 38	37 15	36 52	36 29	36 06	48
52	47 19	46 52	46 25	45 58	45 31	45 04	44 37	44 10	43 43	43 16	42 49	42 22	52
56	54 53	54 21	53 50	53 19	52 47	52 16	51 44	51 13	50 42	50 10	49 39	49 07	56
60	63 00	62 24	61 48	61 12	60 36	60 00	59 24	58 48	58 12	57 36	57 00	56 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.05	1.04	1.03	1.02	1.01	1.00	0.99	0.98	0.97	0.96	0.95	0.94	$\triangle_1 h$
Log.	0.021 19	0.017 03	0.012 84	0.008 60	0.004 32	0.00 . . .	9.995 64	9.991 23	9.986 77	9.982 27	9.977 72	9.973 13	Log.
Limit	70	71	71	72	72	72	73	74	75	76	77	78	Minutes
Meridian	19°	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	0 14	...	...	...	...	...	...	...	...	...	4
8	0 59	0 58	0 58	...	...	...	...	...	...	...	...	...	8
12	2 13	2 13	2 11	...	...	...	...	...	...	...	...	...	12
16	3 57	3 55	3 53	...	...	...	...	...	...	...	...	...	16
20	6 12	6 08	6 04	...	...	...	...	...	...	...	...	...	20
24	8 56	8 50	8 44	...	...	...	...	...	...	...	...	...	24
28	12 09	12 02	11 54	...	...	...	...	...	...	...	...	...	28
32	15 52	15 42	15 32	...	...	...	...	...	...	...	...	...	32
36	20 05	19 52	19 39	...	...	...	...	...	...	...	...	...	36
40	24 48	24 32	24 16	...	...	...	...	...	...	...	...	...	40
44	30 00	29 41	29 21	...	...	...	...	...	...	...	...	...	44
48	35 43	35 20	34 57	...	...	...	...	...	...	...	...	...	48
52	44 55	41 28	41 01	...	...	...	...	...	...	...	...	...	52
56	48 36	48 05	47 33	...	...	...	...	...	...	...	...	...	56
60	55 48	55 12	54 36	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.93	0.92	0.91	...	...	...	...	...	...	...	...	...	$\triangle_1 h$
Log.	9.968 48	9.963 79	9.959 04	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	Log.
Limit	79	80	80										Minutes
Meridian	7°	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 13	0 13	0 13	0 12	0 12	0 12	0 12	0 12	0 12	0 12	0 12	0 11	4
8	0 52	0 52	0 51	0 51	0 50	0 50	0 50	0 49	0 48	0 48	0 47	0 46	8
12	1 58	1 56	1 55	1 54	1 53	1 52	1 51	1 50	1 48	1 47	1 45	1 44	12
16	3 30	3 28	3 25	3 22	3 19	3 18	3 17	3 14	3 12	3 09	3 07	3 04	16
20	5 28	5 24	5 20	5 16	5 12	5 10	5 08	5 04	5 00	4 56	4 52	4 48	20
24	7 53	7 47	7 41	7 35	7 29	7 26	7 23	7 18	7 12	7 06	7 00	6 55	24
28	10 43	10 35	10 27	10 20	10 12	10 08	10 04	9 56	9 48	9 40	9 33	9 25	28
32	13 59	13 49	13 39	13 29	13 19	13 14	13 09	12 58	12 48	12 38	12 28	12 17	32
36	17 43	17 30	17 17	17 04	16 51	16 44	16 38	16 25	16 12	15 59	15 46	15 33	36
40	21 52	21 36	21 20	21 04	20 48	20 40	20 32	20 16	20 00	19 44	19 28	19 12	40
44	26 28	26 08	25 49	25 29	25 10	25 00	24 51	24 31	24 12	23 52	23 33	23 14	44
48	31 29	31 06	30 43	30 18	29 55	29 44	29 32	29 09	28 46	28 23	28 00	27 37	48
52	36 57	36 30	36 03	35 36	35 09	34 55	34 42	34 15	33 48	33 21	32 54	32 27	52
56	42 52	42 20	41 49	41 17	40 46	40 30	40 15	39 44	39 12	38 40	38 09	37 38	56
60	49 12	48 36	48 00	47 24	46 48	46 30	46 12	45 36	45 00	44 24	43 48	43 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.82	0.81	0.80	0.79	0.78	0.775	0.77	0.76	0.75	0.74	0.73	0.72	$\triangle_1 h$
Log.	9.913 81	9.908 49	9.903 09	9.897 63	9.892 09	9.889 30	9.886 49	9.880 81	9.875 06	9.869 23	9.863 32	9.857 33	Log.
Limit	92	92	92	92	92	92	92	92	92	92	92	92	Minutes
Meridian	5°	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	Altitudes

Latitude 59° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 10	0 10	0 10	0 09	4
8	0 46	0 45	0 44	0 44	0 44	0 42	0 41	0 41	0 40	0 40	0 39	0 38	8
12	1 42	1 41	1 39	1 38	1 36	1 35	1 32	1 30	1 29	1 27	1 26	1 25	12
16	3 02	2 59	2 57	2 54	2 52	2 49	2 44	2 42	2 39	2 37	2 34	2 31	16
20	4 44	4 40	4 36	4 32	4 28	4 24	4 16	4 12	4 08	4 04	4 00	3 56	20
24	6 49	6 43	6 38	6 32	6 26	6 21	6 09	6 03	5 58	5 52	5 46	5 40	24
28	9 17	9 09	9 01	8 53	8 45	8 37	8 21	8 14	8 06	7 58	7 50	7 43	28
32	12 07	11 57	11 46	11 36	11 26	11 15	10 55	10 45	10 34	10 24	10 14	10 04	32
36	15 20	15 07	14 55	14 42	14 29	14 16	13 50	13 37	13 24	13 11	12 58	12 45	36
40	18 56	18 40	18 24	18 08	17 52	17 36	17 04	16 48	16 32	16 16	16 00	15 44	40
44	22 54	22 35	22 16	21 57	21 38	21 18	20 39	20 20	20 01	19 41	19 22	19 02	44
48	27 14	26 51	26 29	26 08	25 43	25 20	24 34	24 11	23 48	23 25	23 02	22 39	48
52	32 00	31 33	31 05	30 38	30 11	29 44	28 50	28 33	27 56	27 29	27 02	26 35	52
56	37 06	36 35	36 04	35 33	35 02	34 30	33 27	32 56	32 25	31 53	31 22	30 50	56
60	42 36	42 00	41 24	40 48	40 12	39 36	38 24	37 48	37 12	36 36	36 00	35 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.71	0.70	0.69	0.68	0.67	0.66	0.64	0.63	0.62	0.61	0.60	0.59	$\triangle_1 h$
Log.	9.851 26	9.845 10	9.838 85	9.832 51	9.826 07	9.819 54	9.806 18	9.799 34	9.792 39	9.785 33	9.778 15	9.770 85	Log.
Limit	92	92	92	92	92	92	92	92	92	92	92	92	Minutes
Meridian	17°	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 09	0 09	0 09	0 09	0 09	0 08	0 08	0 08	0 07	0 07	0 07	0 06	4
8	0 38	0 37	0 37	0 35	0 35	0 32	0 32	0 31	0 31	0 29	0 28	0 28	8
12	1 24	1 22	1 21	1 18	1 16	1 13	1 12	1 09	1 08	1 05	1 04	1 02	12
16	2 28	2 26	2 23	2 18	2 16	2 11	2 08	2 03	2 00	1 55	1 52	1 50	16
20	3 52	3 48	3 44	3 36	3 32	3 24	3 20	3 12	3 08	3 00	2 56	2 52	20
24	5 34	5 28	5 23	5 11	5 05	4 54	4 48	4 36	4 30	4 19	4 13	4 07	24
28	7 35	7 27	7 19	7 03	6 56	6 40	6 32	6 16	6 09	5 53	5 45	5 38	28
32	9 54	9 44	9 33	9 13	9 03	8 42	8 32	8 12	8 02	7 41	7 31	7 21	32
36	12 32	12 19	12 06	11 40	11 27	11 01	10 48	10 22	10 09	9 43	9 30	9 17	36
40	15 28	15 12	14 56	14 24	14 08	13 36	13 20	12 48	12 32	12 00	11 44	11 28	40
44	18 43	18 24	18 04	17 25	17 06	16 27	16 08	15 29	15 10	14 31	14 12	13 52	44
48	22 16	21 53	21 30	20 44	20 21	19 35	19 12	18 26	18 03	17 17	16 54	16 31	48
52	26 08	25 41	25 14	24 20	23 53	22 59	22 32	21 38	21 11	20 17	19 50	19 23	52
56	30 19	29 48	29 16	28 13	27 42	26 39	26 08	25 05	24 34	23 31	23 00	22 28	56
60	34 48	34 12	33 36	32 24	31 48	30 36	30 00	28 48	28 12	27 00	26 24	25 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.58	0.57	0.56	0.54	0.53	0.51	0.50	0.48	0.47	0.45	0.44	0.43	$\triangle_1 h$
Log.	9.763 43	9.755 87	9.748 19	9.732 39	9.724 28	9.707 57	9.698 97	9.681 24	9.672 10	9.653 21	9.643 45	9.633 47	Log.
Limit	92	92	92	92	92	92	92	92	92	92	92	92	Minutes
Meridian	29°	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	Altitudes

Latitude 60° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 20	0 20	0 20	4
8	1 12	1 13	1 14	1 15	1 15	1 16	1 17	1 18	1 19	1 20	1 21	1 22	8
12	2 42	2 45	2 47	2 48	2 50	2 51	2 54	2 56	2 57	3 00	3 02	3 05	12
16	4 50	4 55	4 57	5 00	5 02	5 05	5 10	5 12	5 15	5 20	5 22	5 27	16
20	7 32	7 40	7 44	7 48	7 52	7 56	8 04	8 08	8 12	8 20	8 24	8 32	20
24	10 51	11 03	11 09	11 14	11 20	11 26	11 37	11 43	11 48	12 00	12 06	12 17	24
28	14 46	15 01	15 09	15 17	15 25	15 33	15 49	15 57	16 05	16 20	16 28	16 44	28
32	19 17	19 37	19 47	19 58	20 08	20 18	20 39	20 49	21 00	21 20	21 30	21 51	32
36	24 25	24 51	25 04	25 17	25 30	25 43	26 08	26 21	26 34	27 00	27 13	27 39	36
40	30 08	30 40	30 56	31 12	31 28	31 44	32 16	32 32	32 48	33 20	33 36	34 08	40
44	36 28	37 07	37 26	37 46	38 05	38 24	39 02	39 22	39 41	40 20	40 39	41 18	44
48	43 23	44 09	44 32	44 55	45 18	45 41	46 28	46 51	47 14	48 00	48 23	49 09	48
52	50 55	51 49	52 16	52 43	53 10	53 37	54 32	54 59	55 26	56 20	56 47	57 41	52
56	59 04	60 07	60 38	61 10	61 41	62 12	63 14	63 46	64 17	65 20	65 51	66 54	56
60	67 48	69 00	69 36	70 12	70 48	71 24	72 36	73 12	73 48	75 00	75 36	76 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.13	1.15	1.16	1.17	1.18	1.19	1.21	1.22	1.23	1.25	1.26	1.28	Δ_1h
Log.	0.053 08	0.060 70	0.064 46	0.068 19	0.071 88	0.075 55	0.082 79	0.086 36	0.089 91	0.096 91	0.100 37	0.107 21	Log.
Limit	66	66	65	64	63	62	62	61	60	60	59	58	Minutes
Meridian	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 21	0 21	0 22	0 22	0 22	0 22	0 22	0 22	0 23	0 23	0 24	4
8	1 23	1 23	1 24	1 26	1 27	1 28	1 30	1 31	1 33	1 34	1 35	1 36	8
12	3 06	3 08	3 10	3 13	3 16	3 19	3 22	3 25	3 28	3 31	3 34	3 36	12
16	5 30	5 36	5 38	5 43	5 48	5 53	5 58	6 03	6 08	6 13	6 18	6 24	16
20	8 36	8 44	8 48	8 56	9 04	9 12	9 20	9 28	9 36	9 44	9 52	10 00	20
24	12 23	12 35	12 41	12 52	13 04	13 15	13 36	13 38	13 49	14 01	14 12	14 24	24
28	16 52	17 07	17 15	17 30	17 46	18 02	18 18	18 34	18 49	19 05	19 21	19 36	28
32	22 01	22 21	22 31	22 52	23 12	23 33	23 54	24 14	24 35	24 55	25 16	25 36	32
36	27 52	28 18	28 31	28 57	29 23	29 49	30 14	30 40	31 06	31 32	31 58	32 24	36
40	34 24	34 56	35 12	35 44	36 16	36 48	37 20	37 52	38 24	38 56	39 28	40 00	40
44	41 37	42 16	42 36	43 14	43 53	44 32	45 10	45 49	46 27	47 06	47 25	48 24	44
48	49 32	50 18	50 41	51 27	52 13	52 59	53 46	54 32	55 18	56 04	56 50	57 36	48
52	58 08	59 02	59 29	60 23	61 17	62 11	63 06	64 00	64 54	65 48	66 42	67 36	52
56	67 25	68 28	69 00	70 02	71 05	72 08	73 10	74 13	75 15	76 18	77 21	78 24	56
60	77 24	78 36	79 12	80 24	81 36	82 48	84 00	85 12	86 24	87 36	88 48	90 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.29	1.31	1.32	1.34	1.36	1.38	1.40	1.42	1.44	1.46	1.48	1.50	Δ_1h
Log.	0.110 59	0.117 27	0.120 57	0.127 10	0.133 54	0.139 88	0.146 13	0.152 29	0.158 36	0.164 35	0.170 26	0.176 09	Log.
Limit	58	57	57	56	55	55	54	53	53	52	51	50	Minutes
Meridian	42°	43°	44°	45°	46°	47°	48°	49°	50°	51°	52°	53°	Altitudes

Latitude 60° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 25	0 25	0 26	0 27	0 27	0 27	0 28	0 29	0 29	0 30	0 30	4
8	1 38	1 39	1 41	1 43	1 45	1 47	1 49	1 52	1 54	1 56	1 59	2 01	8
12	3 40	3 43	3 48	3 51	3 56	4 00	4 05	4 11	4 15	4 20	4 28	4 34	12
16	6 32	6 37	6 44	6 53	7 00	7 08	7 15	7 25	7 33	7 44	7 56	8 06	16
20	10 12	10 20	10 32	10 44	10 56	11 08	11 20	11 36	11 48	12 04	12 24	12 40	20
24	14 41	14 53	15 10	15 28	15 45	16 02	16 19	16 42	16 59	17 23	17 52	18 14	24
28	20 00	20 15	20 39	21 02	21 25	21 49	22 13	22 44	23 08	23 39	24 18	24 50	28
32	26 07	26 27	26 58	27 28	27 59	28 30	29 01	29 42	30 13	30 53	31 44	32 26	32
36	33 03	33 29	34 08	34 47	35 26	36 05	36 43	37 35	38 14	39 06	40 11	41 02	36
40	40 48	41 20	42 08	42 56	43 44	44 32	45 20	46 24	47 12	48 16	49 36	50 40	40
44	49 22	50 01	50 59	51 57	52 55	53 54	54 51	56 08	57 07	58 24	60 01	61 18	44
48	58 45	59 31	60 40	61 49	62 58	64 07	65 15	66 47	67 56	69 30	71 25	72 58	48
52	68 57	69 51	71 12	72 33	73 54	75 15	76 37	78 25	79 46	...	...	...	52
56	79 58	81 01	82 35	84 09	85 43	...	...	...	...	...	...	...	56
60	91 48	93 00	94 48	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.53	1.55	1.58	1.61	1.64	1.67	1.70	1.74	1.77	1.81	1.86	1.90	$\triangle_1$h
Log.	0.184 69	0.190 33	0.198 66	0.206 83	0.214 84	0.222 72	0.230 45	0.240 55	0.247 97	0.257 68	0.269 51	0.278 75	Log.
Limit	49	49	48	47	46	45	45	44	43	42	41	41	Minutes
Meridian	54°	55°	56°	57°	58°	59°	60°	61°	62°	63°	64°	65°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 31	0 32	0 33	0 34	0 35	0 37	0 38	0 40	0 41	0 44	0 46	0 47	4
8	2 04	2 08	2 12	2 16	2 21	2 26	2 32	2 37	2 44	2 51	3 02	3 10	8
12	4 41	4 48	4 59	5 07	5 17	5 28	5 39	5 54	6 09	6 27	6 48	7 09	12
16	8 19	8 32	8 49	9 05	9 23	9 44	10 05	10 30	10 55	11 25	12 00	12 42	16
20	13 00	13 20	13 48	14 16	14 40	15 12	15 44	16 24	17 04	17 52	18 48	19 50	20
24	18 43	19 12	19 52	20 27	21 07	21 54	22 40	23 38	24 35	25 44	27 04	28 36	24
28	25 29	26 08	27 03	27 49	28 45	29 47	30 50	32 08	33 25	35 02	36 52	38 57	28
32	33 17	34 08	35 20	36 21	37 33	38 55	40 16	41 58	43 41	45 44	48 07	50 52	32
36	42 07	43 12	44 43	46 01	47 31	49 15	51 00	53 08	55 18	57 44	60 55	64 22	36
40	52 00	53 20	55 12	56 48	58 40	60 48	62 56	65 36	68 16	71 28	...	...	40
44	62 55	64 32	66 48	68 44	70 59	...	...	...	...	...	...	...	44
48	74 53	76 48	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.95	2.00	2.07	2.13	2.20	2.28	2.36	2.46	2.56	2.68	2.82	2.98	$\triangle_1$h
Log.	0.290 03	0.301 03	0.315 97	0.328 38	0.342 42	0.357 93	0.372 91	0.390 94	0.408 24	0.428 13	0.450 25	0.474 22	Log.
Limit	40	39	38	37	36	35	34	33	32	31	30	29	Minutes
Meridian	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	77°	Altitudes

Latitude 60° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 51	0 54	0 59	1 03	1 10	1 18	1 28	1 43	...	...	...	...	4
8	3 22	3 36	3 52	4 13	4 38	5 10	5 53	6 54	...	...	...	...	8
12	7 35	8 07	8 42	9 31	10 25	11 38	13 15	15 31	...	...	...	...	12
16	13 28	14 25	15 30	16 53	18 31	20 42	23 33	27 33	...	...	...	...	16
20	21 03	22 32	24 12	26 24	28 56	32 20	36 48	43 04	...	...	...	...	20
24	30 21	32 27	34 51	38 01	41 40	46 34	53 00	...	...	...	...	...	24
28	41 17	44 10	47 26	51 45	56 42	...	...	...	...	...	...	...	28
32	53 55	57 41	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	3.16	3.38	3.63	3.96	4.34	4.85	5.52	6.46	...	...	...	...	$\Delta_1 h$
Log.	0.499 69	0.528 92	0.559 91	0.597 70	0.637 49	0.685 74	0.741 94	0.810 23	... ...	... ...	... ...	... ...	Log.
Limit	26	25	24	23	22	20	18	15	12	9	6	3	Minutes
Meridian	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	89°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	1 16	1 01	0 50	0 42	0 36	0 31	0 26	4
8	...	...	...	...	...	5 05	4 05	3 22	2 49	2 25	2 03	1 42	8
12	...	...	...	...	...	11 26	9 10	7 34	6 20	5 24	4 39	3 51	12
16	...	...	...	...	...	20 18	16 18	13 27	11 15	9 36	8 14	6 53	16
20	...	...	...	...	...	31 44	25 29	21 00	17 36	15 00	12 52	10 44	20
24	...	...	...	...	...	...	36 41	30 14	25 21	21 36	18 31	15 28	24
28	...	...	...	...	...	...	...	41 09	34 29	29 24	25 13	21 02	28
32	...	...	...	...	...	...	...	...	45 03	38 24	32 57	27 28	32
36	...	...	...	...	...	...	...	...	...	48 36	41 41	34 47	36
40	...	...	...	...	...	...	...	...	...	...	51 28	42 56	40
44	...	...	...	...	...	...	...	...	...	...	...	51 57	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	...	...	4.76	3.82	3.15	2.64	2.25	1.93	1.61	$\Delta_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	0.677 61	0.582 06	0.498 31	0.421 60	0.352 18	0.285 56	0.206 83	Log.
Limit	0	3	6	9	12	16	19	22	25	28	32	36	Minutes
Meridian	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	79°	Altitudes

Latitude 60° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 18	0 18	0 18	0 17	0 17	0 17	0 17	0 17	0 17	0 16	0 16	4
8	1 12	1 11	1 11	1 10	1 10	1 09	1 08	1 08	1 07	1 07	1 06	1 05	8
12	2 42	2 41	2 39	2 38	2 37	2 36	2 34	2 33	2 31	2 30	2 28	2 27	12
16	4 50	4 47	4 45	4 42	4 39	4 36	4 34	4 31	4 29	4 26	4 24	4 21	16
20	7 32	7 28	7 24	7 20	7 16	7 12	7 08	7 04	7 00	6 56	6 52	6 48	20
24	10 51	10 46	10 40	10 34	10 28	10 22	10 16	10 11	10 05	9 59	9 53	9 48	24
28	14 46	14 38	14 30	14 22	14 15	14 07	13 59	13 51	13 43	13 35	13 28	13 20	28
32	19 17	19 06	18 56	18 46	18 36	18 26	18 16	18 05	17 55	17 45	17 35	17 24	32
36	24 25	24 12	23 59	23 46	23 33	23 20	23 07	22 54	22 41	22 28	22 15	22 02	36
40	30 08	29 52	29 36	29 20	29 04	28 48	28 32	28 16	28 00	27 44	27 28	27 12	40
44	36 28	36 09	35 49	35 30	35 10	34 51	34 32	34 12	33 53	33 33	33 14	32 55	44
48	43 23	43 00	42 37	42 14	41 51	41 28	41 05	40 42	40 19	39 56	39 33	39 10	48
52	50 55	50 28	50 01	49 34	49 07	48 40	48 13	47 46	47 19	46 52	46 25	45 58	52
56	59 04	58 33	58 01	57 30	56 58	56 27	55 56	55 24	54 53	54 21	53 50	53 19	56
60	67 48	67 12	66 36	66 00	65 24	64 48	64 12	63 36	63 00	62 24	61 48	61 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.13	1.12	1.11	1.10	1.09	1.08	1.07	1.06	1.05	1.04	1.03	1.02	$\Delta_1 h$
Log.	0.053 08	0.049 22	0.045 32	0.041 39	0.037 43	0.033 42	0.029 39	0.025 31	0.021 19	0.017 03	0.012 84	0.008 60	Log.
Limit	66	66	67	67	68	68	68	69	69	70	70	70	Minutes
Meridian	30°	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 16	0 16	0 15	0 15	0 15	0 15	0 15	0 15	0 15	0 14	0 14	0 14	4
8	1 04	1 04	1 03	1 02	1 02	1 01	1 01	1 00	1 00	0 59	0 58	0 58	8
12	2 25	2 24	2 33	2 22	2 20	2 19	2 17	2 16	2 16	2 14	2 13	2 11	12
16	4 19	4 16	4 13	4 10	4 08	4 05	4 03	4 01	4 00	3 58	3 55	3 53	16
20	6 44	6 40	6 36	6 32	6 28	6 24	6 20	6 18	6 16	6 12	6 08	6 04	20
24	9 42	9 36	9 30	9 24	9 18	9 13	9 07	9 04	9 01	8 55	8 50	8 44	24
28	13 12	13 04	12 57	12 49	12 41	12 33	12 25	12 21	12 17	12 10	12 02	11 54	28
32	17 14	17 04	16 54	16 44	16 34	16 23	16 13	16 08	16 03	15 53	15 42	15 32	32
36	21 49	21 36	21 23	21 10	20 57	20 44	20 31	20 24	20 18	20 05	19 52	19 39	36
40	26 56	26 40	26 24	26 08	25 52	25 36	25 20	25 12	25 04	24 48	24 32	24 16	40
44	32 35	32 16	31 56	31 37	31 18	30 58	30 39	30 29	30 19	30 00	29 41	29 21	44
48	38 47	38 24	38 01	37 38	37 15	36 52	36 29	36 18	36 06	35 43	35 20	34 57	48
52	45 31	45 04	44 37	44 10	43 43	43 16	42 49	42 35	42 22	41 55	41 28	41 01	52
56	52 47	52 16	51 44	51 13	50 42	50 10	49 39	49 22	49 07	48 36	48 05	47 33	56
60	60 36	60 00	59 24	58 48	58 12	57 36	57 00	56 42	56 24	55 48	55 12	54 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.01	1.00	0.99	0.98	0.97	0.96	0.95	0.945	0.94	0.93	0.92	0.91	$\Delta_1 h$
Log.	0.004 32	0.00 . . .	9.995 64	9.991 23	9.986 77	9.982 27	9.977 72	9.975 43	9.973 13	9.968 48	9.963 79	9.959 04	Log.
Limit	71	72	73	73	73	73	74	75	76	77	78	79	Minutes
Meridian	18°	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	Altitudes

Latitude 60° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	...	...	...	...	...	...	...	...	...	0 13	4
8	0 57	0 57	...	...	...	...	...	...	...	...	...	0 51	8
12	2 10	2 08	...	...	...	...	...	...	...	...	...	1 55	12
16	3 50	3 48	...	...	...	...	...	...	...	...	...	3 25	16
20	6 00	5 56	...	...	...	...	...	...	...	...	...	5 20	20
24	8 38	8 33	...	...	...	...	...	...	...	...	...	7 41	24
28	11 46	11 38	...	...	...	...	...	...	...	...	...	10 27	28
32	15 22	15 11	...	...	...	...	...	...	...	...	...	13 39	32
36	19 26	19 14	...	...	...	...	...	...	...	...	...	17 17	36
40	24 00	23 44	...	...	...	...	...	...	...	...	...	21 20	40
44	29 02	28 43	...	...	...	...	...	...	...	...	...	25 49	44
48	34 34	34 10	...	...	...	...	...	...	...	...	...	30 43	48
52	40 34	40 06	...	...	...	...	...	...	...	...	...	36 03	52
56	47 02	46 31	...	...	...	...	...	...	...	...	...	41 49	56
60	54 00	53 24	...	...	...	...	...	...	...	...	...	48 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	0.90	0.89	...	...	...	...	...	...	...	...	...	0.80	Δ_1h
Log.	9.954 24	9.949 39	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.903 09	Log.
Limit	80	80										95	Minutes
Meridian	6°	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 12	0 12	0 12	0 12	0 12	0 12	0 12	0 11	0 11	0 11	4
8	0 51	0 50	0 50	0 50	0 49	0 49	0 48	0 48	0 47	0 46	0 46	0 45	8
12	1 54	1 53	1 53	1 51	1 50	1 50	1 48	1 47	1 45	1 44	1 42	1 41	12
16	3 22	3 21	3 19	3 17	3 15	3 14	3 12	3 09	3 07	3 04	3 02	2 59	16
20	5 16	5 14	5 12	5 08	5 06	5 04	5 00	4 56	4 52	4 48	4 44	4 40	20
24	7 35	7 32	7 29	7 23	7 20	7 18	7 12	7 06	7 00	6 55	6 49	6 43	24
28	10 20	10 16	10 12	10 04	10 00	9 56	9 48	9 40	9 33	9 25	9 17	9 09	28
32	13 29	13 24	13 19	13 09	13 03	12 58	12 48	12 38	12 28	12 17	12 07	11 57	32
36	17 04	16 57	16 51	16 38	16 32	16 25	16 12	15 59	15 46	15 33	15 20	15 07	36
40	21 04	20 56	20 48	20 32	20 24	20 16	20 00	19 44	19 28	19 12	18 56	18 40	40
44	25 29	25 20	25 10	24 51	24 41	24 31	24 12	23 52	23 33	23 14	22 54	22 35	44
48	30 18	30 07	29 55	29 32	29 20	29 09	28 46	28 23	28 00	27 37	27 14	26 51	48
52	35 36	35 23	35 09	34 42	34 28	34 15	33 48	33 21	32 54	32 27	32 00	31 33	52
56	41 17	41 02	40 46	40 15	40 00	39 44	39 12	38 41	38 09	37 38	37 06	36 35	56
60	47 24	47 06	46 48	46 12	44 54	45 36	45 00	44 24	43 48	43 12	42 36	42 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	0.79	0.785	0.78	0.77	0.765	0.76	0.75	0.74	0.73	0.72	0.71	0.70	Δ_1h
Log.	9.897 63	9.894 87	9.892 09	9.886 49	9.883 66	9.880 81	9.875 06	9.869 23	9.863 32	9.857 33	9.851 26	9.845 10	Log.
Limit	95	95	95	95	95	95	95	95	95	95	95	95	Minutes
Meridian	6°	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	Altitudes

Latitude 60° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 10	0 10	0 10	0 09	0 09	4
8	0 44	0 44	0 44	0 44	0 42	0 41	0 41	0 39	0 40	0 38	0 38	0 38	8
12	1 40	1 39	1 38	1 36	1 35	1 32	1 30	1 29	1 27	1 26	1 25	1 24	12
16	2 58	2 57	2 54	2 52	2 49	2 44	2 42	2 39	2 37	2 34	2 31	2 28	16
20	4 38	4 36	4 32	4 28	4 24	4 16	4 12	4 08	4 04	4 00	3 56	3 52	20
24	6 40	6 38	6 32	6 26	6 21	6 09	6 03	5 58	5 52	5 46	5 40	5 34	24
28	9 05	9 01	8 53	8 45	8 37	8 21	8 14	8 06	7 58	7 50	7 43	7 35	28
32	11 51	11 46	11 36	11 26	11 15	10 55	10 45	10 34	10 24	10 14	10 04	9 54	32
36	15 01	14 55	14 42	14 29	14 16	13 50	13 37	13 24	13 11	12 58	12 45	12 32	36
40	18 32	18 24	18 08	17 52	17 36	17 04	16 48	16 32	16 16	16 00	15 44	15 28	40
44	22 25	22 16	21 57	21 38	21 18	20 39	20 20	20 01	19 41	19 22	19 02	18 43	44
48	26 40	26 29	26 08	25 43	25 20	24 34	24 11	23 48	23 25	23 02	22 39	22 16	48
52	31 19	31 05	30 38	30 11	29 44	28 50	28 23	27 56	27 29	27 02	26 35	26 08	52
56	36 19	36 04	35 33	35 02	34 30	33 27	32 56	32 25	31 53	31 22	30 50	30 19	56
60	41 42	41 24	40 48	40 12	39 36	38 24	37 48	37 12	36 36	36 00	35 24	34 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.695	0.69	0.68	0.67	0.66	0.64	0.63	0.62	0.61	0.60	0.59	0.58	$\triangle_1 h$
Log.	9.841 98	9.838 85	9.832 51	9.826 07	9.819 54	9.806 18	9.799 34	9.792 39	9.785 33	9.778 15	9.770 85	9.763 43	Log.
Limit	95	95	95	95	95	95	95	95	95	95	95	95	Minutes
Meridian	18°	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 09	0 09	0 09	0 09	0 09	0 08	0 08	0 07	0 07	0 07	0 07	0 06	4
8	0 37	0 37	0 36	0 35	0 33	0 32	0 31	0 31	0 30	0 29	0 28	0 28	8
12	1 22	1 21	1 19	1 16	1 15	1 12	1 11	1 08	1 07	1 05	1 04	1 02	12
16	2 26	2 23	2 21	2 16	2 13	2 08	2 05	2 00	1 57	1 55	1 52	1 50	16
20	3 48	3 44	3 40	3 32	3 28	3 20	3 16	3 08	3 04	3 00	2 56	2 52	20
24	5 28	5 23	5 17	5 05	5 00	4 48	4 42	4 30	4 25	4 19	4 13	4 07	24
28	7 27	7 19	7 11	6 56	6 48	6 32	6 25	6 09	6 01	5 53	5 45	5 38	28
32	9 44	9 33	9 23	9 03	8 52	8 32	8 22	8 02	7 51	7 41	7 31	7 21	32
36	12 19	12 06	11 53	11 27	11 14	10 48	10 35	10 09	9 56	9 43	9 30	9 17	36
40	15 12	14 56	14 40	14 08	13 52	13 20	13 04	12 32	12 16	12 00	11 44	11 28	40
44	18 24	18 04	17 45	17 06	16 47	16 08	15 48	15 10	14 50	14 31	14 12	13 52	44
48	21 53	21 30	21 07	20 21	19 58	19 12	18 49	18 03	17 40	17 17	16 54	16 31	48
52	25 41	25 14	24 47	23 53	23 26	22 32	22 05	21 11	20 46	20 17	19 50	19 23	52
56	29 48	29 16	28 45	27 42	27 11	26 08	25 36	24 34	24 02	23 31	23 00	22 28	56
60	34 12	33 36	33 00	31 48	31 12	30 00	29 24	28 12	27 36	27 00	26 24	25 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.57	0.56	0.55	0.53	0.52	0.50	0.49	0.47	0.46	0.45	0.44	0.43	$\triangle_1 h$
Log.	9.755 87	9.748 19	9.740 36	9.724 28	9.716 00	9.698 97	9.690 20	9.672 10	9.662 76	9.653 21	9.643 45	9.633 47	Log.
Limit	95	95	95	95	95	95	95	95	95	95	95	95	Minutes
Meridian	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	Altitudes

Latitude 61° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 18	0 18	0 18	0 18	0 19	0 19	0 19	0 19	0 19	0 19	0 19	4
8	1 10	1 10	1 11	1 11	1 12	1 13	1 14	1 15	1 15	1 16	1 17	1 18	8
12	2 37	2 38	2 39	2 41	2 42	2 44	2 47	2 48	2 50	2 51	2 54	2 56	12
16	4 39	4 42	4 45	4 47	4 50	4 52	4 57	5 00	5 02	5 05	5 10	5 12	16
20	7 16	7 20	7 24	7 28	7 32	7 36	7 44	7 48	7 52	7 56	8 04	8 08	20
24	10 28	10 34	10 40	10 46	10 51	10 57	11 09	11 14	11 20	11 26	11 37	11 43	24
28	14 15	14 22	14 30	14 38	14 46	14 53	15 09	15 17	15 25	15 33	15 49	15 57	28
32	18 36	18 46	18 56	19 06	19 17	19 27	19 47	19 58	20 08	20 18	20 39	20 49	32
36	23 33	23 46	23 59	24 12	24 25	24 38	25 04	25 17	25 30	25 43	26 08	26 21	36
40	29 04	29 20	29 36	29 52	30 08	30 24	30 56	31 12	31 28	31 44	32 16	32 32	40
44	35 10	35 30	35 49	36 09	36 28	36 47	37 26	37 46	38 05	38 24	39 02	39 22	44
48	41 51	42 14	42 37	43 00	43 23	43 46	44 32	44 55	45 18	45 41	46 28	46 51	48
52	49 07	49 34	50 01	50 28	50 55	51 22	52 16	52 43	53 10	53 37	54 32	54 59	52
56	56 58	57 30	58 01	58 33	59 04	59 35	60 38	61 10	61 41	62 12	63 14	63 46	56
60	65 24	66 00	66 36	67 12	67 48	68 24	69 36	70 12	70 48	71 24	72 36	73 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.09	1.10	1.11	1.12	1.13	1.14	1.16	1.17	1.18	1.19	1.21	1.22	$\triangle_1 h$
Log.	0.037 43	0.041 39	0.045 32	0.049 22	0.053 08	0.056 90	0.064 46	0.068 19	0.071 88	0.075 55	0.082 79	0.086 36	Log
Limit	67	66	65	64	63	63	63	62	61	61	61	60	Minutes
Meridian	29°	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 20	0 20	0 20	0 20	0 21	0 21	0 22	0 22	0 22	0 22	0 22	4
8	1 19	1 20	1 21	1 22	1 23	1 23	1 25	1 26	1 27	1 28	1 30	1 31	8
12	2 57	3 00	3 02	3 05	3 06	3 08	3 11	3 14	3 16	3 19	3 22	3 25	12
16	5 15	5 20	5 22	5 27	5 30	5 36	5 41	5 46	5 48	5 53	5 58	6 03	16
20	8 12	8 20	8 24	8 32	8 36	8 44	8 52	9 00	9 04	9 12	9 20	9 28	20
24	11 48	12 00	12 06	12 17	12 23	12 35	12 46	12 58	13 04	13 15	13 26	13 38	24
28	16 05	16 20	16 28	16 44	16 52	17 07	17 23	17 38	17 46	18 02	18 18	18 34	28
32	21 00	21 20	21 30	21 51	22 01	22 21	22 42	23 02	23 12	23 33	23 54	24 14	32
36	26 34	27 00	27 13	27 39	27 52	28 18	28 44	29 10	29 23	29 49	30 14	30 40	36
40	32 48	33 20	33 36	34 08	34 24	34 56	35 28	36 00	36 16	36 48	37 20	37 52	40
44	39 41	40 20	40 39	41 18	41 37	42 16	42 55	43 34	43 53	44 32	45 10	45 49	44
48	47 14	48 00	48 23	49 09	49 32	50 18	51 04	51 50	52 13	52 59	53 46	54 32	48
52	55 26	56 20	56 47	57 41	58 08	59 02	59 56	60 50	61 17	62 11	63 06	64 00	52
56	64 17	65 20	65 51	66 54	67 25	68 28	69 31	70 34	71 05	72 08	73 10	74 13	56
60	73 48	75 00	75 36	76 48	77 24	78 36	79 48	81 00	81 36	82 48	84 00	85 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.23	1.25	1.26	1.28	1.29	1.31	1.33	1.35	1.36	1.38	1.40	1.42	$\triangle_1 h$
Log.	0.089 91	0.096 91	0.100 37	0.107 21	0.110 59	0.117 27	0.123 85	0.130 33	0.133 54	0.139 88	0.146 13	0.152 29	Log.
Limit	59	59	58	58	57	56	56	55	55	54	53	52	Minutes
Meridian	41°	42°	43°	44°	45°	46°	47°	48°	49°	50°	51°	52°	Altitudes

Latitude 61° Declination Same Name.

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 23	0 24	0 24	0 25	0 25	0 26	0 27	0 27	0 27	0 28	0 29	4
8	1 33	1 35	1 36	1 37	1 39	1 41	1 42	1 45	1 47	1 50	1 52	1 54	8
12	3 28	3 32	3 36	3 39	3 43	3 46	3 50	3 56	4 00	4 06	4 11	4 17	12
16	6 08	6 16	6 24	6 29	6 37	6 42	6 50	7 00	7 08	7 18	7 25	7 35	16
20	9 36	9 48	10 00	10 08	10 20	10 28	10 40	10 56	11 08	11 24	11 36	11 52	20
24	13 49	14 06	14 24	14 36	14 53	15 04	15 22	15 45	16 02	16 25	16 42	17 05	24
28	18 49	19 13	19 36	19 52	20 15	20 31	20 54	21 25	21 49	22 21	22 44	23 16	28
32	24 35	25 06	25 36	25 56	26 27	26 48	27 18	27 59	28 30	29 11	29 42	30 23	32
36	31 06	31 45	32 24	32 50	33 29	33 55	34 34	35 26	36 05	36 56	37 35	38 27	36
40	38 24	39 12	40 00	40 32	41 20	41 52	42 40	43 44	44 32	45 36	46 24	47 28	40
44	46 27	47 26	48 24	49 03	50 01	50 40	51 38	52 55	53 54	55 10	56 08	57 26	44
48	55 18	56 27	57 36	58 22	59 31	60 17	61 26	62 58	64 07	65 38	66 47	68 19	48
52	64 54	66 15	67 36	68 30	69 51	70 45	72 06	73 54	75 15	77 04	78 25	...	52
56	75 15	76 50	78 24	79 27	81 01	82 04	83 38	85 43	87 18	...	...	...	56
60	86 24	88 12	90 00	91 12	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.44	1.47	1.50	1.52	1.55	1.57	1.60	1.64	1.67	1.71	1.74	1.78	$\Delta_1 h$
Log.	0.158 36	0.167 32	0.176 09	0.181 84	0.190 33	0.195 90	0.204 12	0.214 84	0.222 72	0.233 00	0.240 55	0.250 42	Log.
Limit	51	51	50	49	48	47	47	46	45	44	43	42	Minutes
Meridian	53°	54°	55°	56°	57°	58°	59°	60°	61°	62°	63°	64°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 30	0 31	0 31	0 33	0 34	0 35	0 37	0 38	0 39	0 42	0 44	4
8	1 57	2 00	2 03	2 07	2 11	2 15	2 21	2 25	2 31	2 37	2 47	2 58	8
12	4 23	4 31	4 39	4 47	4 54	5 06	5 17	5 28	5 40	5 52	6 16	6 37	12
16	7 49	8 01	8 14	8 29	8 42	9 02	9 23	9 43	10 04	10 24	11 06	11 43	16
20	12 12	12 32	12 52	13 16	13 36	14 08	14 40	15 12	15 44	16 16	17 20	18 20	20
24	17 34	18 03	18 31	19 06	19 35	20 21	21 07	21 54	22 40	23 25	24 58	26 24	24
28	23 55	24 34	25 13	26 01	26 39	27 41	28 45	29 47	30 50	31 53	33 59	35 57	28
32	31 14	32 05	32 57	33 58	34 49	36 11	37 33	38 55	40 16	41 39	44 22	46 56	32
36	39 32	40 37	41 41	42 59	44 04	45 48	47 31	49 15	50 59	52 42	56 10	59 24	36
40	48 48	50 08	51 18	53 04	54 24	56 32	58 40	60 48	62 56	65 04	69 20	...	40
44	59 03	60 40	62 16	64 12	65 49	68 25	70 59	...	...	...	...	...	44
48	70 16	72 11	74 07	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.83	1.88	1.93	1.99	2.04	2.12	2.20	2.28	2.36	2.44	2.60	2.75	$\Delta_1 h$
Log.	0.262 45	0.274 16	0.285 56	0.298 85	0.309 63	0.326 34	0.342 42	0.357 93	0.372 91	0.387 39	0.414 97	0.439 33	Log.
Limit	41	40	39	38	38	37	36	35	34	33	32	31	Minutes
Meridian	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	76°	Altitudes

Latitude 61° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 47	0 49	0 51	0 55	1 00	1 06	1 13	1 23	1 38	...	...	...	4
8	3 07	3 15	3 26	3 41	4 00	4 23	4 54	5 34	6 31	...	...	...	8
12	7 00	7 19	7 42	8 17	9 00	9 53	11 01	12 32	14 39	...	...	...	12
16	12 20	13 01	13 42	14 43	16 00	17 35	19 35	22 16	26 05	...	...	...	16
20	19 20	20 20	21 24	23 00	25 00	27 28	30 36	34 48	40 44	...	...	...	20
24	27 50	29 17	30 49	33 07	36 00	39 34	44 04	...	...	...	...	...	24
28	37 54	39 51	41 57	45 05	49 00	53 50	...	...	...	...	...	...	28
32	49 30	52 03	54 47	58 53	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	2.90	3.05	3.21	3.45	3.75	4.12	4.59	5.22	6.11	...	...	...	Δ_1h
Log.	0.462 40	0.484 30	0.506 51	0.537 82	0.574 03	0.614 90	0.661 81	0.717 67	0.786 04	... ...	... ...	... ...	Log.
Limit	28	27	26	25	24	22	20	17	15	12	9	6	Minutes
Meridian	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	88°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	1 11	0 59	0 46	0 39	0 33	0 27	4
8	...	...	...	...	...	...	4 45	3 53	3 07	2 37	2 12	1 47	8
12	...	...	...	...	...	...	10 40	8 44	7 02	5 53	4 57	4 00	12
16	...	...	...	...	...	...	18 56	15 32	12 30	10 27	8 47	7 08	16
20	...	...	...	...	...	...	29 36	24 16	19 32	16 20	13 44	11 08	20
24	...	...	...	...	...	...	...	34 57	28 07	23 31	19 47	16 02	24
28	...	...	...	...	...	...	...	...	38 18	32 01	26 55	21 49	28
32	...	...	...	...	...	...	...	...	...	41 49	35 09	28 30	32
36	...	...	...	...	...	...	...	...	...	...	44 30	36 05	36
40	...	...	...	...	...	...	...	...	...	...	...	44 32	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	...	...	...	...	...	...	4.44	3.64	2.93	2.45	2.06	1.67	Δ_1h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	0.647 38	0.561 10	0.466 87	0.389 17	0.313 87	0.222 72	Log.
Limit	3	0	3	6	9	14	17	20	23	27	31	35	Minutes
Meridian	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	80°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 17	0 17	0 17	0 17	0 16	0 16	0 16	0 16	0 15	0 15	4
8	1 10	1 09	1 08	1 08	1 07	1 07	1 06	1 05	1 04	1 04	1 03	1 02	8
12	2 37	2 36	2 34	2 33	2 31	2 30	2 28	2 27	2 25	2 24	2 23	2 22	12
16	4 39	4 36	4 34	4 31	4 29	4 26	4 24	4 21	4 19	4 16	4 13	4 10	16
20	7 16	7 12	7 08	7 04	7 00	6 56	6 52	6 48	6 44	6 40	6 36	6 32	20
24	10 28	10 22	10 16	10 11	10 05	9 59	9 53	9 48	9 42	9 36	9 30	9 24	24
28	14 15	14 07	13 59	13 51	13 43	13 35	13 28	13 20	13 12	13 04	12 57	12 49	28
32	18 36	18 26	18 16	18 05	17 55	17 45	17 35	17 24	17 14	17 04	16 54	16 44	32
36	23 33	23 20	23 07	22 54	22 41	22 28	22 15	22 02	21 49	21 36	21 23	21 10	36
40	29 04	28 48	28 32	28 16	28 00	27 44	27 28	27 12	26 56	26 40	26 24	26 08	40
44	35 10	34 51	34 22	34 12	33 53	33 33	33 14	32 55	32 35	32 16	31 56	31 37	44
48	41 51	41 28	41 05	40 42	40 19	39 56	39 33	39 10	38 47	38 24	38 01	37 38	48
52	49 07	48 40	48 13	47 46	47 19	46 52	46 25	45 58	45 31	45 04	44 37	44 10	52
56	56 58	56 27	55 56	55 24	54 53	54 21	53 50	53 19	52 47	52 16	51 44	51 13	56
60	65 24	64 48	64 12	63 36	63 00	62 24	61 48	61 12	60 36	60 00	59 24	58 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.09	1.08	1.07	1.06	1.05	1.04	1.03	1.02	1.01	1.00	0.99	0.98	$\Delta_1 h$
Log.	0.037 43	0.033 42	0.029 38	0.025 31	0.021 19	0.017 03	0.012 84	0.008 60	0.004 32	0.00 ...	9.995 64	9.991 23	Log.
Limit	68	68	69	69	70	70	70	71	71	72	72	72	Minutes
Meridian	29°	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 15	0 15	0 15	0 15	0 14	0 14	0 14	0 14	0 14	0 14	0 14	4
8	1 02	1 01	1 01	1 01	1 00	0 59	0 58	0 58	0 57	0 57	0 57	0 56	8
12	2 20	2 19	2 18	2 17	2 16	2 14	2 13	2 11	2 10	2 10	2 08	2 07	12
16	4 08	4 05	4 04	4 03	4 00	3 58	3 55	3 53	3 51	3 50	3 48	3 45	16
20	6 28	6 24	6 22	6 20	6 16	6 12	6 08	6 04	6 02	6 00	5 56	5 52	20
24	9 18	9 13	9 10	9 07	9 01	8 55	8 50	8 44	8 41	8 38	8 33	8 27	24
28	12 41	12 33	12 29	12 25	12 17	12 10	12 02	11 54	11 50	11 46	11 38	11 30	28
32	16 34	16 23	16 18	16 13	16 03	15 53	15 42	15 32	15 27	15 22	15 11	15 01	32
36	20 57	20 44	20 37	20 31	20 18	20 05	19 52	19 39	19 32	19 26	19 14	19 01	36
40	25 52	25 36	25 28	25 20	25 04	24 48	24 32	24 16	24 08	24 00	23 44	23 28	40
44	31 18	30 58	30 49	30 39	30 19	30 00	29 41	29 21	29 12	29 02	28 43	28 24	44
48	37 15	36 52	36 40	36 29	36 06	35 43	35 20	34 57	34 45	34 34	34 10	33 47	48
52	43 43	43 16	43 03	42 49	42 22	41 55	41 28	41 01	40 48	40 34	40 06	39 39	52
56	50 42	50 10	49 54	49 39	49 07	48 36	48 05	47 33	47 18	47 02	46 31	46 00	56
60	58 12	57 36	57 18	57 00	56 24	55 48	55 12	54 36	54 18	54 00	53 24	52 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.97	0.96	0.955	0.95	0.94	0.93	0.92	0.91	0.905	0.90	0.89	0.88	$\Delta_1 h$
Log.	9.986 77	9.982 27	9.980 00	9.977 72	9.973 13	9.968 48	9.963 79	9.959 04	9.956 65	9.954 24	9.949 39	9.944 48	Log.
Limit	72	73	74	74	74	74	75	76	77	78	79	80	Minutes
Meridian	17°	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	Altitudes

Latitude 61° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	...	...	...	...	...	...	...	...	0 13	0 12	0 12	4
8	0 55	...	...	...	...	...	...	...	...	0 51	0 51	0 50	8
12	2 05	...	...	...	...	...	...	...	...	1 55	1 54	1 53	12
16	3 43	...	...	...	...	...	...	...	...	3 25	3 22	3 19	16
20	5 48	...	...	...	...	...	...	...	...	5 20	5 16	5 12	20
24	8 21	...	...	...	...	...	...	...	...	7 41	7 35	7 29	24
28	11 22	...	...	...	...	...	...	...	...	10 27	10 20	10 12	28
32	14 51	...	...	...	...	...	...	...	...	13 39	13 29	13 19	32
36	18 48	...	...	...	...	...	...	...	...	17 17	17 04	16 51	36
40	23 12	...	...	...	...	...	...	...	...	21 20	21 04	20 48	40
44	28 05	...	...	...	...	...	...	...	...	25 49	25 29	25 10	44
48	33 24	...	...	...	...	...	...	...	...	30 43	30 18	29 55	48
52	39 12	...	...	...	...	...	...	...	...	36 03	35 36	35 09	52
56	45 29	...	...	...	...	...	...	...	...	41 49	41 17	40 46	56
60	52 12	...	...	...	...	...	...	...	...	48 00	47 24	46 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.87	...	...	...	...	...	...	...	...	0.80	0.79	0.78	$\triangle_1$h
Log.	9.939 52	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.903 09	9.897 63	9.892 09	Log.
Limit	80									99	99	99	Minutes
Meridian	5°	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 12	0 12	0 12	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 11	4
8	0 50	0 50	0 49	0 48	0 47	0 47	0 46	0 46	0 46	0 45	0 44	0 43	8
12	1 52	1 51	1 50	1 48	1 47	1 45	1 45	1 44	1 42	1 41	1 39	1 37	12
16	3 18	3 17	3 14	3 12	3 09	3 07	3 06	3 04	3 02	2 59	2 57	2 54	16
20	5 10	5 08	5 04	5 00	4 56	4 52	4 50	4 48	4 44	4 40	4 36	4 32	20
24	7 26	7 23	7 18	7 12	7 06	7 00	6 57	6 55	6 49	6 43	6 38	6 32	24
28	10 08	10 04	9 56	9 48	9 40	9 33	9 29	9 25	9 17	9 09	9 01	8 53	28
32	13 14	13 09	12 58	12 48	12 38	12 28	12 22	12 17	12 07	11 57	11 46	11 36	32
36	16 44	16 38	16 25	16 12	15 59	15 46	15 40	15 33	15 20	15 07	14 55	14 42	36
40	20 40	20 32	20 16	20 00	19 44	19 28	19 20	19 12	18 56	18 40	18 24	18 08	40
44	25 00	24 51	24 31	24 12	23 52	23 33	23 23	23 14	22 54	22 35	22 16	21 57	44
48	29 44	29 32	29 09	28 46	28 23	28 00	27 49	27 37	27 14	26 51	26 29	26 06	48
52	34 55	34 42	34 15	33 48	33 21	32 54	32 40	32 27	32 00	31 33	31 05	30 38	52
56	40 30	40 15	39 44	39 12	38 40	38 09	37 53	37 38	37 07	36 35	36 04	35 33	56
60	46 30	46 12	45 36	45 00	44 24	43 48	43 30	43 12	42 36	42 00	41 24	40 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.775	0.77	0.76	0.75	0.74	0.73	0.725	0.72	0.71	0.70	0.69	0.68	$\triangle_1$h
Log.	9.889 30	9.886 49	9.880 81	9.875 06	9.869 23	9.863 32	9.860 34	9.857 33	9.851 26	9.845 10	9.838 85	9.832 51	Log.
Limit	99	99	99	99	99	99	99	99	99	99	99	99	Minutes
Meridian	7°	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	Altitudes

Latitude 61° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 11	0 11	0 11	0 10	0 10	0 10	0 09	0 09	0 09	4
8	0 43	0 43	0 43	0 42	0 41	0 41	0 39	0 40	0 39	0 38	0 38	0 37	8
12	1 36	1 35	1 33	1 32	1 32	1 30	1 29	1 27	1 26	1 25	1 24	1 22	12
16	2 52	2 49	2 47	2 45	2 44	2 42	2 39	2 37	2 34	2 31	2 28	2 26	16
20	4 28	4 24	4 20	4 18	4 16	4 12	4 08	4 04	4 00	3 56	3 52	3 48	20
24	6 26	6 21	6 18	6 12	6 09	6 03	5 58	5 52	5 46	5 40	5 34	5 28	24
28	8 45	8 37	8 33	8 25	8 21	8 14	8 06	7 58	7 50	7 43	7 35	7 27	28
32	11 26	11 15	11 10	11 00	10 55	10 45	10 34	10 24	10 14	10 04	9 54	9 44	32
36	14 29	14 16	14 09	13 56	13 50	13 37	13 24	13 11	12 58	12 45	12 32	12 19	36
40	17 52	17 36	17 28	17 12	17 04	16 48	16 32	16 16	16 00	15 44	15 28	15 12	40
44	21 38	21 18	21 09	20 49	20 39	20 20	20 01	19 41	19 22	19 02	18 43	18 24	44
48	25 43	25 20	25 07	24 45	24 34	24 11	23 48	23 25	23 02	22 39	22 16	21 53	48
52	30 11	29 44	29 30	29 03	28 50	28 23	27 56	27 29	27 02	26 25	26 08	25 14	52
56	35 02	34 40	34 14	33 43	33 27	32 56	32 25	31 53	31 22	30 50	30 19	29 48	56
60	40 12	39 36	39 18	38 42	38 24	37 48	37 12	36 36	36 00	35 24	34 48	34 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.67	0.66	0.655	0.645	0.64	0.63	0.62	0.61	0.60	0.59	0.58	0.57	$\triangle_1 h$
Log.	9.826 07	9.819 54	9.816 24	9.809 56	9.806 18	9.799 34	9.792 39	9.785 33	9.778 15	9.770 85	9.763 43	9.755 87	Log.
Limit	99	99	99	99	99	99	99	99	99	99	99	99	Minutes
Meridian	19°	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 09	0 09	0 09	0 09	0 08	0 08	0 08	0 07	0 07	0 07	0 07	0 06	4
8	0 36	0 36	0 35	0 33	0 32	0 32	0 31	0 31	0 30	0 29	0 28	0 27	8
12	1 21	1 19	1 16	1 15	1 13	1 12	1 11	1 08	1 07	1 05	1 02	1 01	12
16	2 23	2 21	2 16	2 13	2 11	2 08	2 05	2 00	1 57	1 55	1 50	1 47	16
20	3 44	3 40	3 32	3 28	3 24	3 20	3 16	3 08	3 04	3 00	2 52	2 48	20
24	5 23	5 17	5 05	5 00	4 54	4 48	4 42	4 30	4 25	4 19	4 07	4 02	24
28	7 19	7 11	6 56	6 48	6 40	6 32	6 25	6 09	6 01	5 53	5 38	5 30	28
32	9 33	9 23	9 03	8 52	8 42	8 32	8 22	8 02	7 51	7 41	7 21	7 10	32
36	12 06	11 53	11 27	11 14	11 01	10 48	10 35	10 09	9 56	9 43	9 17	9 04	36
40	14 56	14 40	14 08	13 52	13 36	13 20	13 04	12 32	12 16	12 00	11 28	11 12	40
44	18 04	17 45	17 06	16 47	16 27	16 08	15 48	15 10	14 50	14 31	13 52	13 33	44
48	21 30	21 07	20 21	19 58	19 35	19 12	18 49	18 03	17 40	17 17	16 31	16 08	48
52	25 14	24 47	23 53	23 26	22 59	22 32	22 05	21 11	20 46	20 17	19 23	18 56	52
56	29 16	28 45	27 42	27 11	26 39	26 08	25 36	24 34	24 02	23 31	22 28	21 57	56
60	33 36	33 00	31 48	31 12	30 36	30 00	29 24	28 12	27 36	27 00	25 48	25 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.56	0.55	0.53	0.52	0.51	0.50	0.49	0.47	0.46	0.45	0.43	0.42	$\triangle_1 h$
Log.	9.748 19	9.740 36	9.724 28	9.716 00	9.707 57	9.698 97	9.690 20	9.672 10	9.662 76	9.653 21	9.633 47	9.623 25	Log.
Limit	99	99	99	99	99	99	99	99	99	99	99	99	Minutes
Meridian	31°	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	Altitudes

Latitude 62° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 17	0 17	0 17	0 17	0 18	0 18	0 18	0 19	0 19	0 19	4
8	1 07	1 07	1 08	1 08	1 09	1 10	1 11	1 11	1 12	1 13	1 13	1 14	8
12	2 30	2 31	2 33	2 34	2 36	2 37	2 39	2 41	2 42	2 44	2 45	2 47	12
16	4 26	4 29	4 31	4 34	4 36	4 39	4 45	4 47	4 50	4 52	4 55	4 57	16
20	6 56	7 00	7 04	7 08	7 12	7 16	7 24	7 28	7 32	7 36	7 40	7 44	20
24	9 59	10 05	10 11	10 16	10 22	10 28	10 40	10 46	10 51	10 57	11 03	11 09	24
28	13 35	13 43	13 51	13 59	14 07	14 15	14 30	14 38	14 46	14 53	15 01	15 09	28
32	17 45	17 55	18 05	18 16	18 26	18 36	18 56	19 06	19 17	19 27	19 37	19 47	32
36	22 28	22 41	22 54	23 07	23 20	23 33	23 59	24 12	24 25	24 38	24 51	25 04	36
40	27 44	28 00	28 16	28 32	28 48	29 04	29 36	29 52	30 08	30 24	30 40	30 56	40
44	33 33	33 53	34 12	34 32	34 51	35 10	35 49	36 09	36 28	36 47	37 07	37 26	44
48	39 56	40 19	40 42	41 05	41 28	41 51	42 37	43 00	43 23	43 46	44 09	44 32	48
52	46 52	47 19	47 46	48 13	48 40	49 07	50 01	50 28	50 55	51 22	51 49	52 16	52
56	54 21	54 53	55 24	55 56	56 27	56 58	58 01	58 33	59 04	59 35	60 07	60 38	56
60	62 24	63 00	63 36	64 12	64 48	65 24	66 36	67 12	67 48	68 24	69 00	69 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.04	1.05	1.06	1.07	1.08	1.09	1.11	1.12	1.13	1.14	1.15	1.16	$\Delta_1 h$
Log.	0.017 03	0.021 19	0.025 31	0.029 38	0.033 42	0.037 43	0.045 32	0.049 22	0.053 08	0.056 90	0.060 70	0.064 46	Log.
Limit	69	68	67	66	65	65	64	63	63	62	62	62	Minutes
Meridian	28°	29°	30°	31°	32°	33°	34°	35°	36°	37°	38°	39°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 19	0 19	0 20	0 20	0 20	0 20	0 21	0 21	0 22	4
8	1 15	1 16	1 17	1 18	1 19	1 20	1 21	1 22	1 23	1 23	1 25	1 26	8
12	2 50	2 51	2 53	2 56	2 57	3 00	3 02	3 05	3 06	3 08	3 11	3 14	12
16	5 02	5 05	5 07	5 12	5 15	5 20	5 22	5 27	5 30	5 36	5 41	5 46	16
20	7 52	7 56	8 00	8 08	8 12	8 20	8 24	8 32	8 36	8 44	8 52	9 00	20
24	11 20	11 26	11 31	11 43	11 48	12 00	12 06	12 17	12 23	12 35	12 46	12 58	24
28	15 25	15 33	15 41	15 57	16 05	16 20	16 28	16 44	16 52	17 07	17 23	17 38	28
32	20 08	20 18	20 29	20 49	21 00	21 20	21 30	21 51	22 01	22 21	22 42	23 02	32
36	25 30	25 43	25 55	26 21	26 34	27 00	27 13	27 39	27 52	28 18	28 44	29 10	36
40	31 28	31 44	32 00	32 32	32 48	33 20	33 36	34 08	34 24	34 56	35 28	36 00	40
44	38 05	38 24	38 43	39 22	39 41	40 20	40 39	41 18	41 37	42 16	42 55	43 34	44
48	45 18	45 41	46 05	46 51	47 14	48 00	48 23	49 09	49 32	50 18	51 04	51 50	48
52	53 10	53 37	54 05	54 59	55 26	56 20	56 47	57 41	58 08	59 02	59 56	60 50	52
56	61 41	62 12	62 43	63 46	64 17	65 20	65 51	66 54	67 25	68 28	69 31	70 34	56
60	70 48	71 24	72 00	73 12	73 48	75 00	75 36	76 48	77 24	78 36	79 48	81 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.18	1.19	1.20	1.22	1.23	1.25	1.26	1.28	1.29	1.31	1.33	1.35	$\Delta_1 h$
Log.	0.071 88	0.075 55	0.079 18	0.086 36	0.089 91	0.096 91	0.100 37	0.107 21	0.110 59	0.117 27	0.123 85	0.130 33	Log.
Limit	61	61	60	60	59	58	57	56	56	55	54	53	Minutes
Meridian	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	50°	51°	Altitudes

Latitude 62° Declination Same Name.

Declinations.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 22	0 23	0 23	0 23	0 24	0 25	0 25	0 26	0 26	0 27	4
8	1 28	1 29	1 31	1 33	1 34	1 35	1 37	1 39	1 41	1 42	1 44	1 46	8
12	3 17	3 20	3 23	3 28	3 31	3 33	3 37	3 42	3 46	3 50	3 54	3 59	12
16	5 51	5 56	6 01	6 08	6 13	6 18	6 27	6 34	6 42	6 50	6 58	7 05	16
20	9 08	9 16	9 24	9 36	9 44	9 52	10 04	10 16	10 28	10 40	10 52	11 04	20
24	13 09	13 21	13 32	13 49	14 01	14 12	14 30	14 47	15 04	15 22	15 39	15 57	24
28	17 54	18 10	18 26	18 49	19 05	19 21	19 44	20 07	20 31	20 54	21 18	21 41	28
32	23 23	23 43	24 04	24 35	24 55	25 16	25 46	26 17	26 48	27 18	27 49	28 19	32
36	29 36	30 02	30 27	31 06	31 32	31 58	32 37	33 16	33 55	34 34	35 13	35 52	36
40	36 32	37 04	37 36	38 24	38 56	39 28	40 16	41 04	41 52	42 40	43 28	44 16	40
44	44 13	44 51	45 29	46 27	47 06	47 45	48 43	49 41	50 40	51 38	52 36	53 34	44
48	52 36	53 22	54 09	55 18	56 04	56 50	57 59	59 08	60 17	61 26	62 35	63 44	48
52	61 44	62 38	63 33	64 54	65 48	66 42	68 03	69 24	70 45	72 06	73 27	74 48	52
56	71 37	72 39	73 41	75 15	76 18	77 21	78 55	80 29	82 04	83 38	85 12	...	56
60	82 12	83 24	84 36	86 24	87 36	88 48	90 36	92 24	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.37	1.39	1.41	1.44	1.46	1.48	1.51	1.54	1.57	1.60	1.63	1.66	$\Delta_1 h$
Log.	0.136 72	0.143 01	0.149 22	0.158 36	0.164 35	0.170 26	0.178 98	0.187 52	0.195 90	0.204 12	0.212 19	0.220 11	Log.
Limit	53	52	52	51	50	49	48	47	46	45	44	44	Minutes
Meridian	52°	53°	54°	55°	56°	57°	58°	59°	60°	61°	62°	63°	Altitudes

Declinations.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 27	0 28	0 29	0 30	0 30	0 31	0 31	0 33	0 35	0 36	0 38	0 40	4
8	1 50	1 52	1 55	1 58	2 01	2 04	2 09	2 14	2 18	2 23	2 31	2 39	8
12	4 06	4 12	4 19	4 25	4 32	4 41	4 51	5 01	5 10	5 22	5 40	5 58	12
16	7 18	7 28	7 41	7 51	8 04	8 19	8 37	8 55	9 14	9 31	10 04	10 34	16
20	11 24	11 40	12 00	12 14	12 36	13 00	13 28	13 56	14 24	14 52	15 44	16 32	20
24	16 25	16 48	17 17	17 40	18 09	18 43	19 23	20 04	20 45	21 24	22 40	23 48	24
28	22 21	22 52	23 31	24 02	24 42	25 29	26 25	27 19	28 13	29 08	30 50	32 25	28
32	29 11	29 52	30 43	31 24	32 15	33 17	34 29	35 40	36 51	38 04	40 16	42 20	32
36	36 56	37 48	38 53	39 45	40 50	42 07	43 38	45 09	46 40	48 10	50 59	53 34	36
40	45 36	46 40	48 00	49 04	50 24	52 00	53 52	55 44	57 36	59 28	62 56	66 08	40
44	55 10	56 28	58 05	59 22	60 59	62 55	65 11	67 26	...	...	...	...	44
48	65 38	67 10	69 07	70 39	72 34	...	...	...	...	...	...	...	48
52	77 04	78 52	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.71	1.75	1.80	1.84	1.89	1.95	2.02	2.09	2.16	2.23	2.36	2.48	$\Delta_1 h$
Log.	0.233 00	0.243 04	0.255 27	0.264 82	0.276 46	0.290 03	0.305 35	0.320 15	0.334 45	0.348 30	0.372 91	0.394 45	Log.
Limit	43	42	41	40	39	38	37	36	35	34	33	32	Minutes
Meridian	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	75°	Altitudes

Latitude 62° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 43	0 43	0 46	0 49	0 52	0 57	1 02	1 10	1 18	1 28	...	...	4
8	2 47	2 54	3 02	3 15	3 30	3 47	4 09	4 38	5 15	5 52	...	...	8
12	6 16	6 31	6 50	7 18	7 51	8 31	9 20	10 25	11 50	13 12	...	...	12
16	11 04	11 36	12 10	12 58	13 57	15 09	16 36	18 31	21 02	23 28	...	...	16
20	17 20	18 07	19 00	20 16	21 48	23 40	25 56	28 56	32 52	36 40	...	...	20
24	24 58	26 05	27 22	29 11	31 23	34 05	37 21	41 40	47 19	...	...	...	24
28	33 59	35 33	37 14	39 43	42 44	46 23	50 50	...	...	...	...	...	28
32	44 22	46 25	48 38	51 53	55 49	...	...	...	...	...	...	...	32
36	56 10	58 45	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	2.60	2.72	2.85	3.04	3.27	3.55	3.89	4.34	4.93	5.50	...	...	$\triangle_1 h$
Log.	0.414 97	0.434 57	0.454 84	0.482 87	0.514 55	0.550 23	0.589 95	0.637 49	0.692 85	0.740 36	... ...	... ...	Log.
Limit	30	29	28	27	26	24	22	20	18	15	12	9	Minutes
Meridian	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	87°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	1 06	0 53	0 43	0 36	0 29	4
8	...	...	...	...	...	...	...	4 24	3 31	2 54	2 26	1 56	8
12	...	...	...	...	...	...	...	9 54	7 55	6 32	5 27	4 22	12
16	...	...	...	...	...	...	...	17 38	14 05	11 36	9 41	7 46	16
20	...	...	...	...	...	...	...	27 32	22 00	18 08	15 08	12 08	20
24	...	...	...	...	...	...	...	39 39	31 41	26 07	21 47	17 29	24
28	...	...	...	...	...	...	...	...	43 07	35 33	29 40	23 47	28
32	...	...	...	...	...	...	...	...	...	46 25	38 45	31 03	32
36	...	...	...	...	...	...	...	...	...	...	49 02	39 19	36
40	...	...	...	...	...	...	...	...	...	...	...	48 32	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	4.13	3.30	2.72	2.27	1.82	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.615 95	0.518 51	0.434 57	0.356 03	0.260 07	Log.
Limit	6	3	0	4	8	12	16	20	24	26	29	32	Minutes
Meridian	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	81°	Altitudes

Latitude 62° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 16	0 16	0 16	0 16	0 16	0 15	0 15	0 15	0 15	0 15	0 15	4
8	1 07	1 06	1 05	1 04	1 04	1 04	1 03	1 02	1 02	1 01	1 01	1 00	8
12	2 30	2 28	2 27	2 26	2 25	2 24	2 23	2 22	2 20	2 19	2 17	2 16	12
16	4 26	4 24	4 21	4 20	4 19	4 16	4 13	4 10	4 08	4 05	4 03	4 01	16
20	6 56	6 52	6 48	6 46	6 44	6 40	6 36	6 32	6 28	6 24	6 20	6 18	20
24	9 59	9 53	9 48	9 45	9 42	9 36	9 30	9 24	9 18	9 13	9 07	9 04	24
28	13 35	13 28	13 20	13 16	13 12	13 04	12 57	12 49	12 41	12 33	12 25	12 21	28
32	17 45	17 35	17 24	17 19	17 14	17 04	16 54	16 44	16 34	16 23	16 13	16 08	32
36	22 28	22 15	22 02	21 55	21 49	21 36	21 23	21 10	20 57	20 44	20 31	20 24	36
40	27 44	27 28	27 12	27 04	26 56	26 40	26 24	26 08	25 52	25 36	25 20	25 12	40
44	33 33	33 14	32 55	32 45	32 35	32 16	31 56	31 37	31 18	30 58	30 39	30 29	44
48	39 56	39 33	39 10	38 59	38 47	38 24	38 01	37 38	37 15	36 52	36 29	36 18	48
52	46 52	49 25	45 58	45 45	45 31	45 04	44 37	44 10	43 43	43 16	42 49	42 35	52
56	54 21	53 50	53 19	53 03	52 47	52 16	51 44	51 13	50 42	50 10	49 39	49 23	56
60	62 24	61 48	61 12	60 54	60 36	60 00	59 24	58 48	58 12	57 36	57 00	56 42	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.04	1.03	1.02	1.015	1.01	1.00	0.99	0.98	0.97	0.96	0.95	0.945	$\triangle_1 h$
Log.	0.017 03	0.012 84	0.008 60	0.006 47	0.004 32	0.00 ...	9.995 64	9.991 23	9.986 77	9.982 27	9.977 72	9.975 43	Log.
Limit	70	70	70	71	71	71	71	71	72	73	73	73	Minutes
Meridian	28°	27°	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	4
8	1 00	0 59	0 58	0 58	0 57	0 57	0 57	0 56	0 55	0 55	0 55	0 54	8
12	2 16	2 14	2 13	2 11	2 10	2 10	2 08	2 07	2 05	2 04	2 04	2 02	12
16	4 00	3 58	3 55	3 53	3 51	3 50	3 48	3 45	3 43	3 42	3 40	3 38	16
20	6 16	6 12	6 08	6 04	6 02	6 00	5 56	5 52	5 48	5 46	5 44	5 40	20
24	9 01	8 55	8 50	8 44	8 41	8 38	8 33	8 27	8 21	8 19	8 16	8 10	24
28	12 17	12 10	12 02	11 54	11 50	11 46	11 38	11 30	11 22	11 18	11 14	11 06	28
32	16 03	15 53	15 42	15 32	15 27	15 22	15 11	15 01	14 51	14 45	14 40	14 30	32
36	20 18	20 05	19 52	19 39	19 32	19 26	19 14	19 01	18 48	18 42	18 35	18 22	36
40	25 04	24 48	24 32	24 16	24 08	24 00	23 44	23 28	23 12	23 04	22 56	22 40	40
44	30 19	30 00	29 41	29 21	29 12	29 02	28 43	28 24	28 05	27 55	27 45	27 26	44
48	36 06	35 43	35 20	34 57	34 45	34 34	34 10	33 47	33 24	33 12	33 01	32 38	48
52	42 22	41 55	41 28	41 01	40 47	40 34	40 06	39 39	39 12	38 59	38 45	38 18	52
56	49 07	48 36	48 05	47 33	47 18	47 02	46 31	46 00	45 29	45 13	44 57	44 26	56
60	56 24	55 48	55 12	54 36	54 18	54 00	53 24	52 48	52 12	51 54	51 36	51 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.94	0.93	0.92	0.91	0.905	0.90	0.89	0.88	0.87	0.865	0.86	0.85	$\triangle_1 h$
Log.	9.973 13	9.968 48	9.963 79	9.959 04	9.956 65	9.954 24	9.949 39	9.944 48	9.939 52	9.937 02	9.934 50	9.929 42	Log.
Limit	74	75	75	75	75	76	77	78	79	79	80	80	Minutes
Meridian	16°	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	Altitudes

Latitude 62° Declination Contrary Name.

Declinations. — Inferior Meridian.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	...	...	...	...	...	...	...	...	...	0 12	0 12	0 12	4
8	...	...	...	...	...	...	...	...	...	0 50	0 50	0 49	8
12	...	...	...	...	...	...	...	...	...	1 52	1 51	1 50	12
16	...	...	...	...	...	...	...	...	...	3 18	3 17	3 14	16
20	...	...	...	...	...	...	...	...	...	5 10	5 06	5 04	20
24	...	...	...	...	...	...	...	...	...	7 26	7 23	7 18	24
28	...	...	...	...	...	...	...	...	...	10 08	10 04	9 56	28
32	...	...	...	...	...	...	...	...	...	13 14	13 09	12 58	32
36	...	...	...	...	...	...	...	...	...	16 44	16 38	16 25	36
40	...	...	...	...	...	...	...	...	...	20 40	20 32	20 16	40
44	...	...	...	...	...	...	...	...	...	25 00	24 51	24 31	44
48	...	...	...	...	...	...	...	...	...	29 44	29 32	29 09	48
52	...	...	...	...	...	...	...	...	...	34 55	34 42	34 15	52
56	...	...	...	...	...	...	...	...	...	40 30	40 15	39 44	56
60	...	...	...	...	...	...	...	...	...	46 30	46 12	45 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	...	...	...	...	...	...	...	...	...	0.775	0.77	0.76	$\triangle_1$h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.889 30	9.886 49	9.880 81	Log.
Limit										101	101	101	Minutes
Meridian	4°	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	Altitudes

Declinations. — Inferior Meridian.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	
Min.													Min.
4	0 12	0 12	0 12	0 12	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	4
8	0 48	0 48	0 48	0 47	0 46	0 46	0 45	0 45	0 44	0 44	0 43	0 42	8
12	1 48	1 48	1 47	1 45	1 44	1 42	1 41	1 41	1 39	1 38	1 36	1 35	12
16	3 12	3 10	3 09	3 07	3 04	3 02	3 00	2 59	2 57	2 54	2 52	2 49	16
20	5 00	4 58	4 56	4 52	4 48	4 44	4 42	4 40	4 36	4 32	4 28	4 24	20
24	7 12	7 09	7 06	7 00	6 55	6 49	6 46	6 43	6 38	6 32	6 26	6 21	24
28	9 48	9 44	9 40	9 33	9 25	9 17	9 13	9 09	9 01	8 53	8 45	8 37	28
32	12 48	12 43	12 38	12 28	12 17	12 07	12 02	11 57	11 46	11 36	11 26	11 15	32
36	16 12	16 06	15 59	15 46	15 33	15 20	15 14	15 07	14 55	14 42	14 29	14 16	36
40	20 00	19 52	19 44	19 28	19 12	18 56	18 48	18 40	18 24	18 08	17 52	17 36	40
44	24 12	24 02	23 52	23 33	23 14	22 54	22 44	22 35	22 16	21 57	21 38	21 18	44
48	28 46	28 34	28 23	28 00	27 37	27 14	27 02	26 51	26 29	26 08	25 43	25 20	48
52	33 48	33 34	33 21	32 54	32 27	32 00	31 46	31 33	31 05	30 38	30 11	29 44	52
56	39 12	38 56	38 40	38 09	37 38	37 07	36 51	36 35	36 04	35 33	35 02	34 30	56
60	45 00	44 42	44 24	43 48	43 12	42 36	42 18	42 00	41 24	40 48	40 12	39 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.75	0.745	0.74	0.73	0.72	0.71	0.705	0.70	0.69	0.68	0.67	0.66	$\triangle_1$h
Log.	9.875 06	9.872 16	9.869 23	9.863 32	9.857 33	9.851 26	9.848 19	9.845 10	9.838 85	9.832 51	9.826 07	9.819 54	Log.
Limit	101	101	101	101	101	101	101	101	101	101	101	101	Minutes
Meridian	8°	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	Altitudes

Latitude 62° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 11	0 10	0 10	0 10	0 09	0 09	0 09	0 09	0 09	4
8	0 43	0 42	0 41	0 41	0 40	0 39	0 38	0 38	0 38	0 37	0 36	0 36	8
12	1 34	1 32	1 32	1 30	1 29	1 27	1 26	1 25	1 24	1 22	1 21	1 19	12
16	2 48	2 45	2 44	2 42	2 39	2 37	2 34	2 31	2 28	2 26	2 23	2 21	16
20	4 22	4 18	4 16	4 12	4 08	4 04	4 00	3 56	3 52	3 48	3 44	3 40	20
24	6 18	6 12	6 09	6 03	5 58	5 32	5 46	5 40	5 32	5 28	5 23	5 17	24
28	8 33	8 25	8 21	8 14	8 06	7 58	7 50	7 43	7 35	7 27	7 19	7 11	28
32	11 10	11 00	10 55	10 45	10 34	10 24	10 14	10 04	9 54	9 44	9 33	9 23	32
36	14 10	13 56	13 50	13 37	13 24	13 11	12 58	12 45	12 32	12 18	12 06	11 53	36
40	17 28	17 12	17 04	16 48	16 32	16 16	16 00	15 44	15 28	15 12	14 56	14 40	40
44	21 09	20 49	20 39	20 20	20 01	19 41	19 22	19 02	18 43	18 24	18 04	17 45	44
48	25 08	25 45	24 34	24 11	23 48	23 25	23 02	22 39	22 16	21 53	21 30	21 07	48
52	29 30	29 03	28 50	28 23	27 56	27 29	27 02	26 35	26 08	25 41	25 14	24 47	52
56	34 15	33 43	33 27	32 56	32 25	31 53	31 22	30 50	30 19	29 48	29 16	28 45	56
60	39 18	38 42	38 24	37 48	37 12	36 36	36 00	35 24	34 48	34 12	33 36	33 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.655	0.645	0.64	0.63	0.62	0.61	0.60	0.59	0.58	0.57	0.56	0.55	$\triangle_1 h$
Log.	9.816 24	9.809 56	9.806 18	9.799 34	9.792 39	9.785 33	9.778 15	9.770 85	9.763 43	9.755 87	9.748 19	9.740 36	Log.
Limit	101	101	101	101	101	101	101	101	101	101	101	101	Minutes
Meridian	20°	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°	31°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 09	0 09	0 09	0 08	0 08	0 08	0 08	0 07	0 07	0 07	0 06	0 06	4
8	0 35	0 35	0 33	0 32	0 32	0 31	0 31	0 30	0 29	0 28	0 27	0 27	8
12	1 18	1 16	1 15	1 13	1 12	1 11	1 09	1 07	1 05	1 04	1 02	0 59	12
16	2 18	2 16	2 13	2 11	2 08	2 05	2 02	1 57	1 55	1 52	1 48	1 45	16
20	3 36	3 32	3 28	3 24	3 20	3 16	3 10	3 04	3 00	2 56	2 50	2 44	20
24	5 11	5 05	5 00	4 54	4 48	4 42	4 33	4 25	4 19	4 13	4 05	3 56	24
28	7 03	6 56	6 48	6 40	6 32	6 25	6 12	6 01	5 53	5 45	5 34	5 22	28
32	9 13	9 03	8 52	8 42	8 32	8 22	8 07	7 51	7 41	7 31	7 15	7 00	32
36	11 40	11 27	11 14	11 01	10 48	10 35	10 15	9 56	9 43	9 30	9 10	8 51	36
40	14 24	14 08	13 52	13 36	13 20	13 04	12 40	12 16	12 00	11 44	11 20	10 56	40
44	17 25	17 06	16 47	16 27	16 08	15 48	15 20	14 50	14 31	14 12	13 43	13 13	44
48	20 44	20 21	19 58	19 35	19 12	18 49	18 14	17 40	17 17	16 54	16 19	15 45	48
52	24 20	23 53	23 26	22 59	22 32	22 05	21 24	20 44	20 17	19 50	19 10	18 29	52
56	28 13	27 42	27 11	26 39	26 08	25 36	24 49	24 04	23 31	23 00	22 12	21 25	56
60	32 24	31 48	31 12	30 36	30 00	29 24	28 30	27 36	27 00	26 24	25 30	24 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.54	0.53	0.52	0.51	0.50	0.49	0.475	0.46	0.45	0.44	0.425	0.41	$\triangle_1 h$
Log.	9.732 39	9.724 28	9.716 00	9.707 57	9.698 97	9.690 20	9.676 69	9.662 76	9.653 21	9.643 45	9.628 39	9.612 78	Log.
Limit	101	101	101	101	101	101	101	101	101	101	101	101	Minutes
Meridian	32°	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	Altitudes

Latitude 63° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 16	0 16	0 16	0 16	0 17	0 17	0 17	0 17	0 17	0 17	0 18	0 18	4
8	1 04	1 04	1 05	1 06	1 07	1 07	1 08	1 08	1 09	1 10	1 10	1 11	8
12	2 24	2 25	2 27	2 28	2 30	2 31	2 33	2 34	2 36	2 37	2 38	2 39	12
16	4 16	4 19	4 21	4 24	4 26	4 29	4 31	4 34	4 36	4 39	4 42	4 45	16
20	6 40	6 44	6 48	6 52	6 56	7 00	7 04	7 08	7 12	7 16	7 20	7 24	20
24	9 36	9 42	9 48	9 53	9 59	10 05	10 11	10 16	10 22	10 28	10 34	10 40	24
28	13 04	13 12	13 20	13 28	13 35	13 43	13 51	13 59	14 07	14 15	14 22	14 30	28
32	17 04	17 14	17 24	17 35	17 45	17 55	18 05	18 16	18 26	18 36	18 46	18 56	32
36	21 36	21 49	22 02	22 15	22 28	22 41	22 54	23 07	23 20	23 33	23 46	23 59	36
40	26 40	26 56	27 12	27 28	27 44	28 00	28 16	28 32	28 48	29 04	29 20	29 36	40
44	32 16	32 35	32 55	33 14	33 33	33 53	34 12	34 32	34 51	35 10	35 30	35 49	44
48	38 24	38 47	39 10	39 33	39 56	40 19	40 42	41 05	41 28	41 51	42 14	42 37	48
52	45 04	45 31	45 58	46 25	46 52	47 19	47 46	48 13	48 40	49 07	49 34	50 01	52
56	52 16	52 47	53 19	53 50	54 21	54 53	55 24	55 56	56 27	56 58	57 30	58 01	56
60	60 00	60 36	61 12	61 48	62 24	63 00	63 36	64 12	64 48	65 24	66 00	66 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	$\Delta_1 h$
Log.	0.00 . . .	0.004 32	0.008 60	0.012 84	0.017 03	0.021 19	0.025 31	0.029 38	0.033 42	0.037 43	0.041 39	0.045 32	Log.
Limit	71	70	69	68	67	66	66	65	65	64	64	63	Minutes
Meridian	27°	28°	29°	30°	31°	32°	33°	34°	35°	36°	37°	38°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 18	0 18	0 19	0 19	0 19	0 19	0 19	0 19	0 19	0 20	0 20	0 20	4
8	1 11	1 12	1 13	1 14	1 15	1 16	1 17	1 17	1 19	1 20	1 21	1 22	8
12	2 41	2 42	2 45	2 47	2 48	2 51	2 53	2 54	2 57	2 59	3 02	3 05	12
16	4 47	4 50	4 55	4 57	5 00	5 05	5 07	5 10	5 15	5 17	5 22	5 27	16
20	7 28	7 32	7 40	7 44	7 48	7 56	8 00	8 04	8 12	8 16	8 24	8 32	20
24	10 46	10 51	11 03	11 09	11 14	11 26	11 31	11 37	11 48	11 54	12 06	12 17	24
28	14 38	14 46	15 01	15 09	15 17	15 33	15 41	15 49	16 05	16 12	16 28	16 44	28
32	19 06	19 17	19 37	19 47	19 58	20 18	20 29	20 39	21 00	21 10	21 30	21 51	32
36	24 12	24 25	24 51	25 04	25 17	25 43	25 55	26 08	26 34	26 47	27 13	27 39	36
40	29 52	30 08	30 40	30 56	31 12	31 44	32 00	32 16	32 48	33 04	33 36	34 08	40
44	36 09	36 28	37 07	37 26	37 46	38 24	38 43	39 02	39 41	40 00	40 39	41 18	44
48	43 00	43 23	44 09	44 32	44 55	45 41	46 05	46 28	47 14	47 37	48 23	49 09	48
52	50 28	50 55	51 49	52 16	52 43	53 37	54 05	54 32	55 26	55 53	56 47	57 41	52
56	58 33	59 04	60 07	60 38	61 10	62 12	62 43	63 14	64 17	64 48	65 51	66 54	56
60	67 12	67 48	69 00	69 36	70 12	71 24	72 00	72 36	73 48	74 24	75 36	76 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.12	1.13	1.15	1.16	1.17	1.19	1.20	1.21	1.23	1.24	1.26	1.28	$\Delta_1 h$
Log.	0.049 22	0.053 08	0.060 70	0.064 46	0.068 19	0.075 55	0.079 18	0.082 79	0.089 91	0.093 42	0.100 37	0.107 21	Log.
Limit	62	62	61	61	60	59	59	58	58	57	56	55	Minutes
Meridian	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	50°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 20	0 21	0 22	0 22	0 22	0 23	0 23	0 23	0 24	0 24	0 25	0 25	4
8	1 23	1 24	1 25	1 26	1 28	1 30	1 31	1 33	1 34	1 36	1 38	1 40	8
12	3 06	3 08	3 11	3 14	3 17	3 23	3 25	3 28	3 32	3 36	3 40	3 45	12
16	5 30	5 36	5 41	5 46	5 51	5 59	6 03	6 08	6 17	6 24	6 32	6 39	16
20	8 36	8 44	8 52	9 00	9 08	9 20	9 28	9 36	9 49	10 00	10 12	10 24	20
24	12 23	12 35	12 46	12 58	13 09	13 27	13 38	13 49	14 08	14 23	14 41	14 59	24
28	16 52	17 07	17 23	17 38	17 54	18 19	18 34	18 49	19 14	19 36	20 00	20 23	28
32	22 01	22 21	22 42	23 02	23 23	23 55	24 14	24 35	25 06	25 36	26 07	26 37	32
36	27 52	28 18	28 44	29 10	29 36	30 15	30 40	31 06	31 46	32 24	33 03	33 42	36
40	34 24	34 56	35 28	36 00	36 32	37 19	37 52	38 24	39 12	40 00	40 48	41 36	40
44	41 37	42 16	42 55	43 34	44 13	45 08	45 49	46 27	47 26	48 24	49 22	50 18	44
48	49 32	50 18	51 04	51 50	52 36	53 42	54 32	55 18	56 27	57 36	58 45	59 54	48
52	58 08	59 02	59 56	60 50	61 44	63 06	64 00	64 54	66 15	67 36	68 57	70 18	52
56	67 25	68 28	69 31	70 34	71 37	73 10	74 13	75 15	76 50	78 24	79 58	81 32	56
60	77 24	78 36	79 48	81 00	82 12	84 00	85 12	86 24	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ₁h	1.29	1.31	1.33	1.35	1.37	1.40	1.42	1.44	1.47	1.50	1.53	1.56	Δ₁h
Log.	0.110 59	0.117 27	0.123 85	0.130 33	0.136 72	0.146 13	0.152 29	0.158 36	0.167 32	0.176 09	0.184 69	0.193 12	Log.
Limit	54	54	53	52	51	50	50	49	48	47	46	46	Minutes
Meridian	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	61°	62°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 25	0 26	0 27	0 27	0 28	0 29	0 30	0 31	0 31	0 33	0 35	0 36	4
8	1 42	1 44	1 47	1 49	1 52	1 56	1 59	2 02	2 06	2 11	2 17	2 24	8
12	3 49	3 54	4 00	4 06	4 12	4 20	4 28	4 37	4 46	4 54	5 08	5 23	12
16	6 47	6 58	7 08	7 18	7 28	7 43	7 56	8 11	8 26	8 42	9 08	9 33	16
20	10 36	10 52	11 08	11 24	11 40	12 03	12 24	12 48	13 12	13 36	14 16	14 56	20
24	15 16	15 39	16 02	16 25	16 48	17 23	17 52	18 26	19 00	19 35	20 33	21 30	24
28	20 47	21 18	21 49	22 21	22 52	23 39	24 18	25 06	25 53	26 39	27 57	29 16	28
32	27 08	27 49	28 30	29 11	29 52	30 53	31 44	32 46	33 48	34 49	36 31	38 14	32
36	34 21	35 13	36 05	36 56	37 48	39 06	40 11	41 28	42 46	44 04	46 14	48 23	36
40	42 24	43 28	44 32	45 36	46 40	48 16	49 36	51 12	52 48	54 24	57 04	59 44	40
44	51 18	52 36	53 54	55 10	56 28	58 24	60 01	61 57	63 53	65 49	...	...	44
48	61 03	62 35	64 07	65 38	67 10	69 30	71 25	...	...	...	...	...	48
52	71 39	73 27	75 15	77 04	...	...	...	...	...	...	...	...	52
56	83 06	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ₁h	1.59	1.63	1.67	1.71	1.75	1.81	1.86	1.92	1.98	2.04	2.14	2.24	Δ₁h
Log.	0.201 40	0.212 19	0.222 72	0.233 00	0.243 04	0.257 68	0.269 51	0.283 30	0.296 67	0.309 63	0.330 41	0.350 25	Log.
Limit	45	44	43	42	41	40	39	38	37	36	35	34	Minutes
Meridian	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	74°	Altitudes

Latitude 63° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 38	0 39	0 41	0 43	0 46	0 49	0 54	0 59	1 05	1 15	1 26	...	4
8	2 30	2 37	2 43	2 53	3 04	3 18	3 34	3 55	4 22	4 57	5 47	...	8
12	5 37	5 53	6 07	6 29	6 55	7 25	8 02	8 48	9 49	11 08	13 01	...	12
16	9 59	10 27	10 53	11 31	12 17	13 11	14 18	15 40	17 27	19 48	23 07	...	16
20	15 36	16 20	17 00	18 00	19 12	20 36	22 20	24 28	27 16	30 56	36 08	...	20
24	22 28	23 31	24 29	25 55	27 39	29 40	32 10	35 14	39 16	44 33	...	...	24
28	30 34	32 01	33 19	35 17	37 38	40 23	43 46	47 57	...	...	...	...	28
32	39 56	41 49	43 31	46 05	49 09	52 44	...	...	...	...	...	...	32
36	50 33	52 55	55 05	58 19	...	...	...	...	...	...	...	...	36
40	62 24	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	2.34	2.45	2.55	2.70	2.88	3.09	3.35	3.67	4.09	4.64	5.42	...	△₁h
Log.	0.369 22	0.389 17	0.406 54	0.431 36	0.459 39	0.489 96	0.525 04	0.564 67	0.611 72	0.666 52	0.734 00	... ...	Log.
Limit	32	31	30	29	28	26	24	22	20	18	15	12	Minutes
Meridian	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	86°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	1 01	0 49	0 40	0 31	4
8	...	...	...	...	...	...	...	...	4 05	3 16	2 40	2 04	8
12	...	...	...	...	...	...	...	...	9 11	7 21	6 00	4 40	12
16	...	...	...	...	...	...	...	...	16 21	13 03	10 40	8 16	16
20	...	...	...	...	...	...	...	...	25 32	20 24	16 40	12 56	20
24	...	...	...	...	...	...	...	...	36 46	29 23	24 00	18 37	24
28	...	...	...	...	...	...	...	...	...	39 59	32 40	25 21	28
32	...	...	...	...	...	...	...	...	...	...	42 40	33 07	32
36	...	...	...	...	...	...	...	...	...	...	...	41 54	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	...	...	...	...	...	...	...	...	3.83	3.06	2.50	1.94	△₁h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.583 20	0.485 72	0.397 94	0.287 80	Log.
Limit	10	6	3	0	5	10	14	18	21	24	27	30	Minutes
Meridian	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	82°	Altitudes

Latitude 63° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 16	0 15	0 15	0 15	0 15	0 15	0 15	0 15	0 14	0 14	0 14	0 14	4
8	1 04	1 03	1 02	1 02	1 01	1 01	1 01	1 00	0 59	0 58	0 58	0 58	8
12	2 24	2 23	2 22	2 20	2 20	2 19	2 17	2 16	2 14	2 13	2 13	2 11	12
16	4 16	4 13	4 10	4 08	4 06	4 05	4 03	4 00	3 58	3 56	3 55	3 53	16
20	6 40	6 36	6 32	6 28	6 26	6 24	6 20	6 16	6 12	6 10	6 08	6 04	20
24	9 36	9 30	9 24	9 18	9 16	9 13	9 07	9 01	8 55	8 53	8 50	8 44	24
28	13 04	12 57	12 49	12 41	12 37	12 33	12 25	12 17	12 10	12 06	12 02	11 54	28
32	17 04	16 54	16 44	16 34	16 28	16 23	16 13	16 03	15 53	15 48	15 42	15 32	32
36	21 36	21 23	21 10	20 57	20 50	20 44	20 31	20 18	20 05	19 59	19 52	19 39	36
40	26 40	26 24	26 08	25 52	25 44	25 36	25 20	25 04	24 48	24 40	24 32	24 16	40
44	32 16	31 56	31 37	31 18	31 08	30 58	30 39	30 19	30 00	29 50	29 41	29 21	44
48	38 24	38 01	37 38	37 15	37 04	36 52	36 29	36 06	35 43	35 31	35 20	34 57	48
52	45 04	44 37	44 10	43 43	43 30	43 16	42 49	42 22	41 55	41 42	41 28	41 01	52
56	52 16	51 44	51 13	50 42	50 25	50 10	49 39	49 07	48 36	48 20	48 05	47 33	56
60	60 00	59 24	58 48	58 12	57 54	57 36	57 00	56 24	55 48	55 30	55 12	54 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.00	0.99	0.98	0.97	0.965	0.96	0.95	0.94	0.93	0.925	0.92	0.91	$\Delta_1 h$
Log.	0.00 ...	9.995 64	9.991 23	9.986 77	9.984 53	9.982 27	9.977 72	9.973 13	9.968 48	9.966 14	9.963 79	9.959 04	Log.
Limit	72	72	72	73	73	73	73	73	74	74	74	74	Minutes
Meridian	27°	26°	28°	24°	23°	22°	21°	20°	19°	18°	17°	16°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 13	0 13	0 13	0 13	4
8	0 57	0 57	0 57	0 56	0 55	0 55	0 55	0 54	0 54	0 54	0 53	0 52	8
12	2 10	2 09	2 08	2 07	2 06	2 05	2 04	2 02	2 01	2 01	1 59	1 58	12
16	3 50	3 49	3 48	3 45	3 44	3 43	3 40	3 38	3 36	3 35	3 33	3 30	16
20	6 00	5 58	5 56	5 52	5 50	5 48	5 44	5 40	5 38	5 36	5 32	5 28	20
24	8 38	8 36	8 33	8 27	8 24	8 21	8 16	8 10	8 07	8 04	7 58	7 53	24
28	11 46	11 42	11 38	11 30	11 26	11 22	11 14	11 06	11 02	10 58	10 51	10 43	28
32	15 22	15 16	15 11	15 01	14 56	14 51	14 40	14 30	14 25	14 20	14 10	13 59	32
36	19 26	19 20	19 14	19 01	18 54	18 48	18 35	18 22	18 15	18 09	17 56	17 43	36
40	24 00	23 52	23 44	23 28	23 20	23 12	22 56	22 40	22 32	22 24	22 08	21 52	40
44	29 02	28 53	28 43	28 24	28 15	28 05	27 45	27 26	27 16	27 06	26 47	26 28	44
48	34 34	34 22	34 10	33 47	33 36	33 24	33 01	32 38	32 27	32 15	31 52	31 29	48
52	40 34	40 20	40 06	39 39	39 25	39 12	38 45	38 18	38 04	37 51	37 24	36 57	52
56	47 02	46 46	46 31	46 00	45 45	45 29	44 57	44 26	44 09	43 54	43 23	42 52	56
60	54 00	53 42	53 24	52 48	52 30	52 12	51 36	51 00	50 42	50 24	49 48	49 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.90	0.895	0.89	0.88	0.875	0.87	0.86	0.85	0.845	0.84	0.83	0.82	$\Delta_1 h$
Log.	9.954 24	9.951 82	9.949 39	9.944 48	9.942 01	9.939 52	9.934 50	9.929 42	9.926 86	9.924 28	9.919 08	9.913 81	Log.
Limit	75	75	76	76	76	77	78	79	80	80	81	81	Minutes
Meridian	15°	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	Altitudes

Latitude 63° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	0 12	0 12	0 12	0 12	4
8	...	...	...	...	...	...	...	...	0 49	0 48	0 48	0 48	8
12	...	...	...	...	...	...	...	...	1 50	1 48	1 48	1 47	12
16	...	...	...	...	...	...	...	...	3 14	3 12	3 10	3 09	16
20	...	...	...	...	...	...	...	...	5 04	5 00	4 58	4 56	20
24	...	...	...	...	...	...	...	...	7 18	7 12	7 09	7 06	24
28	...	...	...	...	...	...	...	...	9 56	9 48	9 44	9 40	28
32	...	...	...	...	...	...	...	...	12 58	12 48	12 43	12 38	32
36	...	...	...	...	...	...	...	...	16 25	16 12	16 06	15 59	36
40	...	...	...	...	...	...	...	...	20 16	20 00	19 52	19 44	40
44	...	...	...	...	...	...	...	...	24 31	24 12	24 02	23 52	44
48	...	...	...	...	...	...	...	...	29 09	28 46	28 34	28 23	48
52	...	...	...	...	...	...	...	...	34 15	33 48	33 34	33 21	52
56	...	...	...	...	...	...	...	...	39 44	39 12	38 56	38 40	56
60	...	...	...	...	...	...	...	...	45 36	45 00	44 42	44 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ₁h	...	...	...	...	...	...	...	...	0.76	0.75	0.745	0.74	Δ₁h
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.880 81	9.875 06	9.872 16	9.869 23	Log.
Limit									103	103	103	103	Minutes
Meridian	3°	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 12	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	4
8	0 47	0 46	0 46	0 46	0 45	0 44	0 44	0 43	0 43	0 42	0 42	0 42	8
12	1 45	1 44	1 43	1 42	1 41	1 39	1 39	1 38	1 36	1 35	1 34	1 33	12
16	3 07	3 04	3 03	3 02	2 59	2 57	2 56	2 54	2 52	2 49	2 48	2 47	16
20	4 52	4 48	4 46	4 44	4 40	4 36	4 34	4 32	4 28	4 24	4 22	4 20	20
24	7 00	6 55	6 52	6 49	6 43	6 38	6 36	6 32	6 26	6 21	6 18	6 15	24
28	9 33	9 25	9 21	9 17	9 09	9 01	8 57	8 53	8 45	8 37	8 33	8 29	28
32	12 28	12 17	12 12	12 07	11 57	11 46	11 41	11 36	11 26	11 15	11 10	11 05	32
36	15 46	15 33	15 26	15 20	15 07	14 55	14 48	14 42	14 29	14 16	14 10	14 03	36
40	19 28	19 12	19 04	18 56	18 40	18 24	18 16	18 08	17 52	17 36	17 28	17 20	40
44	23 33	23 14	23 04	22 54	22 35	22 16	22 07	21 57	21 38	21 18	21 09	20 59	44
48	28 00	27 37	27 26	27 14	26 51	26 29	26 18	26 08	25 43	25 20	25 08	24 57	48
52	32 54	32 27	32 13	32 00	31 33	31 05	30 51	30 38	30 11	29 44	29 30	29 17	52
56	38 09	37 38	37 22	37 06	36 35	36 04	35 48	35 33	35 02	34 30	34 15	33 59	56
60	43 48	43 12	42 54	42 36	42 00	41 24	41 06	40 48	40 12	39 36	39 18	39 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ₁h	0.73	0.72	0.715	0.71	0.70	0.69	0.685	0.68	0.67	0.66	0.655	0.65	Δ₁h
Log.	9.863 32	9.857 33	9.854 31	9.851 26	9.845 10	9.838 85	9.835 69	9.832 51	9.826 07	9.819 54	9.816 24	9.812 91	Log.
Limit	103	103	103	103	103	103	103	103	103	103	103	103	Minutes
Meridian	9°	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	Altitudes

Latitude 63° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angle
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 10	0 10	0 10	0 10	0 09	0 09	0 09	0 09	0 09	0 09	4
8	0 40	0 40	0 40	0 39	0 39	0 39	0 38	0 38	0 37	0 36	0 36	0 35	8
12	1 32	1 30	1 29	1 27	1 27	1 26	1 26	1 25	1 22	1 21	1 19	1 18	12
16	2 44	2 42	2 39	2 37	2 36	2 34	2 31	2 28	2 26	2 23	2 21	2 18	16
20	4 16	4 12	4 08	4 04	4 02	4 00	3 56	3 52	3 48	3 44	3 40	3 36	20
24	6 09	6 03	5 58	5 52	5 49	5 46	5 40	5 34	5 28	5 23	5 17	5 11	24
28	8 21	8 14	8 06	7 58	7 54	7 50	7 43	7 35	7 27	7 19	7 11	7 03	28
32	10 55	10 45	10 34	10 24	10 19	10 14	10 04	9 54	9 44	9 33	9 23	9 13	32
36	13 50	13 37	13 24	13 11	13 05	12 58	12 45	12 32	12 19	12 06	11 53	11 40	36
40	17 04	16 48	16 32	16 16	16 08	16 00	15 44	15 28	15 12	14 56	14 40	14 24	40
44	20 39	20 20	20 01	19 41	19 31	19 22	19 02	18 43	18 24	18 04	17 45	17 25	44
48	24 34	24 11	23 48	23 25	23 14	23 02	22 39	22 16	21 53	21 30	21 07	20 44	48
52	28 50	28 23	27 56	27 29	27 15	27 02	26 35	26 08	25 41	25 14	24 47	24 20	52
56	33 27	32 56	32 25	31 53	31 37	31 22	30 50	30 19	29 48	29 16	28 45	28 13	56
60	38 24	37 48	37 12	36 36	36 18	36 00	35 24	34 48	34 12	33 36	33 00	32 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.64	0.63	0.62	0.61	0.605	0.60	0.59	0.58	0.57	0.56	0.55	0.54	$\triangle_1$h
Log.	9.806 18	9.799 34	9.792 39	9.785 33	9.781 76	9.778 15	9.770 85	9.763 43	9.755 87	9.748 19	9.740 36	9.732 39	Log.
Limit	103	103	103	103	103	103	103	103	103	103	103	103	Minutes
Meridian	21°	22°	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 09	0 09	0 08	0 08	0 08	0 08	0 07	0 07	0 07	0 07	0 06	0 06	4
8	0 35	0 33	0 32	0 32	0 31	0 31	0 30	0 29	0 28	0 28	0 27	0 27	8
12	1 16	1 15	1 13	1 12	1 11	1 09	1 08	1 05	1 04	1 02	1 01	0 59	12
16	2 16	2 13	2 11	2 08	2 05	2 03	1 58	1 55	1 52	1 50	1 47	1 45	16
20	3 32	3 28	3 24	3 20	3 16	3 12	3 06	3 00	2 56	2 52	2 48	2 44	20
24	5 05	5 00	4 54	4 48	4 42	4 36	4 28	4 19	4 13	4 07	4 02	3 56	24
28	6 56	6 48	6 40	6 32	6 25	6 16	6 05	5 53	5 45	5 38	5 30	5 22	28
32	9 03	8 52	8 42	8 32	8 22	8 12	7 56	7 41	7 31	7 21	7 10	7 00	32
36	11 27	11 14	11 01	10 48	10 35	10 22	10 02	9 43	9 30	9 17	9 04	8 51	36
40	14 08	13 52	13 36	13 20	13 04	12 48	12 24	12 00	11 44	11 28	11 12	10 56	40
44	17 06	16 47	16 27	16 08	15 48	15 29	15 00	14 31	14 12	13 52	13 33	13 13	44
48	20 21	19 58	19 35	19 12	18 49	18 26	17 52	17 17	16 54	16 31	16 08	15 45	48
52	23 53	23 26	22 59	22 32	22 05	21 38	20 57	20 17	19 50	19 23	18 56	18 29	52
56	27 42	27 11	26 39	26 08	25 36	25 05	24 18	23 31	23 00	22 28	21 57	21 25	56
60	31 48	31 12	30 36	30 00	29 24	28 48	27 54	27 00	26 24	25 48	25 12	24 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.53	0.52	0.51	0.50	0.49	0.48	0.465	0.45	0.44	0.43	0.42	0.41	$\triangle_1$h
Log.	9.724 28	9.716 00	9.707 57	9.698 97	9.690 20	9.681 24	9.667 45	9.653 21	9.643 45	9.633 47	9.623 25	9.612 78	Log.
Limit	103	103	103	103	103	103	103	103	103	103	103	103	Minutes
Meridian	33°	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	Altitudes

Latitude 64° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 15	0 15	0 15	0 15	0 16	0 16	0 16	0 16	0 17	0 17	0 17	4
8	1 01	1 02	1 02	1 02	1 03	1 04	1 04	1 05	1 06	1 07	1 07	1 08	8
12	2 19	2 20	2 21	2 22	2 23	2 24	2 25	2 27	2 28	2 30	2 31	2 33	12
16	4 05	4 08	4 09	4 10	4 13	4 16	4 19	4 21	4 24	4 26	4 29	4 31	16
20	6 24	6 28	6 30	6 32	6 36	6 40	6 44	6 48	6 52	6 56	7 00	7 04	20
24	9 13	9 18	9 21	9 24	9 30	9 36	9 42	9 48	9 53	9 59	10 05	10 11	24
28	12 33	12 41	12 45	12 49	12 57	13 04	13 12	13 20	13 28	13 35	13 43	13 51	28
32	16 23	16 34	16 39	16 44	16 54	17 04	17 14	17 24	17 35	17 45	17 55	18 05	32
36	20 44	20 57	21 03	21 10	21 23	21 36	21 49	22 02	22 15	22 28	22 41	22 54	36
40	25 36	25 52	26 00	26 08	26 24	26 40	26 56	27 12	27 28	27 44	28 00	28 16	40
44	30 58	31 18	31 28	31 37	31 56	32 16	32 35	32 55	33 14	33 33	33 53	34 12	44
48	36 52	37 15	37 27	37 38	38 01	38 24	38 47	39 10	39 33	39 56	40 19	40 42	48
52	43 16	43 43	43 56	44 10	44 37	45 04	45 31	45 58	46 25	46 52	47 19	47 46	52
56	50 10	50 42	50 57	51 13	51 44	52 16	52 47	53 19	53 50	54 21	54 53	55 24	56
60	57 36	58 12	58 30	58 48	59 24	60 00	60 36	61 12	61 48	62 24	63 00	63 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.96	0.97	0.975	0.98	0.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	$\triangle_1 h$
Log.	9.982 27	9.986 77	9.989 00	9.991 23	9.995 64	0.00 ...	0.004 32	0.008 60	0.012 84	0.017 03	0.021 19	0.025 31	Log.
Limit	72	71	70	69	68	68	67	67	66	66	65	65	Minutes
Meridian	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	36°	37°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 17	0 17	0 17	0 18	0 18	0 18	0 19	0 19	0 19	0 19	0 19	0 19	4
8	1 08	1 09	1 10	1 10	1 11	1 11	1 13	1 13	1 14	1 15	1 16	1 17	8
12	2 34	2 36	2 37	2 38	2 39	2 41	2 44	2 45	2 47	2 50	2 51	2 54	12
16	4 34	4 36	4 39	4 42	4 45	4 47	4 52	4 55	4 57	5 02	5 05	5 10	16
20	7 08	7 12	7 16	7 20	7 24	7 28	7 36	7 40	7 44	7 52	7 56	8 04	20
24	10 16	10 22	10 28	10 34	10 40	10 46	10 57	11 03	11 09	11 20	11 26	11 37	24
28	13 59	14 07	14 15	14 22	14 30	14 38	14 53	15 01	15 09	15 25	15 33	15 49	28
32	18 16	18 26	18 36	18 46	18 56	19 06	19 27	19 37	19 47	20 08	20 18	20 39	32
36	23 07	23 20	23 33	23 46	23 59	24 12	24 38	24 51	25 04	25 30	25 43	26 08	36
40	28 32	28 48	29 04	29 20	29 36	29 52	30 24	30 40	30 56	31 28	31 44	32 16	40
44	34 32	34 51	35 10	35 30	35 49	36 09	36 47	37 07	37 26	38 05	38 24	39 02	44
48	41 05	41 28	41 51	42 14	42 37	43 00	43 46	44 09	44 32	45 18	45 41	46 28	48
52	48 13	48 40	49 07	49 34	50 01	50 28	51 22	51 49	52 16	53 10	53 37	54 32	52
56	55 56	56 27	56 58	57 30	58 01	58 33	59 35	60 07	60 38	61 41	62 12	63 14	56
60	64 12	64 48	65 24	66 00	66 36	67 12	68 24	69 00	69 36	70 48	71 24	72 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	1.07	1.08	1.09	1.10	1.11	1.12	1.14	1.15	1.16	1.18	1.19	1.21	$\triangle_1 h$
Log.	0.029 38	0.033 42	0.037 43	0.041 39	0.045 32	0.049 22	0.056 90	0.060 70	0.064 46	0.071 88	0.075 55	0.082 79	Log.
Limit	64	64	63	63	62	61	61	60	60	59	58	57	Minutes
Meridian	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°	49°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 20	0 20	0 20	0 21	0 21	0 21	0 22	0 22	0 22	0 22	0 23	4
8	1 18	1 20	1 21	1 22	1 23	1 33	1 25	1 27	1 28	1 30	1 32	1 33	8
12	2 56	2 59	3 02	3 05	3 07	3 08	3 11	3 16	3 18	3 23	3 24	3 29	12
16	5 12	5 17	5 22	5 27	5 33	5 36	5 41	5 48	5 53	6 01	6 06	6 11	16
20	8 08	8 16	8 24	8 32	8 40	8 44	8 52	9 04	9 12	9 24	9 32	9 40	20
24	11 43	11 54	12 06	12 17	12 29	12 35	12 46	13 04	13 15	13 32	13 43	13 55	24
28	15 57	16 12	16 28	16 44	16 59	17 07	17 23	17 46	18 02	18 26	18 42	18 57	28
32	20 49	21 10	21 30	21 51	22 11	22 21	22 42	23 12	23 33	24 04	24 25	24 45	32
36	26 21	26 47	27 13	27 39	28 05	28 18	28 44	29 23	29 49	30 27	30 53	31 19	36
40	32 32	33 04	33 36	34 08	34 40	34 56	35 28	36 16	36 48	37 36	38 08	38 40	40
44	39 22	40 00	40 39	41 18	41 57	42 16	42 55	43 53	44 32	45 29	46 08	46 47	44
48	46 51	47 37	48 23	49 09	49 55	50 18	51 04	52 13	52 59	54 09	54 55	55 41	48
52	54 59	55 53	56 47	57 41	58 35	59 02	59 56	61 17	62 11	63 33	64 27	65 21	52
56	63 46	64 48	65 51	66 54	67 57	68 28	69 31	71 05	72 08	73 41	74 44	75 37	56
60	73 12	74 24	75 36	76 48	78 00	78 36	79 48	81 36	82 48	84 36	. . .	. . .	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.22	1.24	1.26	1.28	1.30	1.31	1.33	1.36	1.38	1.41	1.43	1.45	Δ_1h
Log.	0.086 36	0.093 42	0.100 37	0.107 21	0.113 94	0.117 27	0.123 85	0.133 54	0.139 88	0.149 22	0.155 34	0.161 37	Log.
Limit	56	56	55	54	53	52	52	51	50	49	48	48	Minutes
Meridian	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	61°	Altitudes

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DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 23	0 24	0 25	0 25	0 26	0 27	0 27	0 28	0 29	0 30	0 31	0 33	4
8	1 36	1 37	1 39	1 42	1 43	1 47	1 50	1 54	1 56	2 00	2 04	2 11	8
12	3 35	3 39	3 43	3 49	3 53	4 00	4 08	4 16	4 22	4 29	4 41	4 54	12
16	6 21	6 29	6 37	6 47	6 55	7 08	7 20	7 33	7 46	7 59	8 19	8 42	16
20	9 56	10 08	10 20	10 36	10 48	11 08	11 28	11 48	12 08	12 28	13 00	13 36	20
24	14 18	14 36	14 53	15 16	15 34	16 02	16 31	16 59	17 29	17 57	18 43	19 35	24
28	19 29	19 52	20 15	20 47	21 10	21 49	22 29	23 08	23 47	24 26	25 29	26 39	28
32	25 26	25 56	26 27	27 08	27 38	28 30	29 21	30 13	31 03	31 55	33 17	34 49	32
36	32 11	32 50	33 29	34 21	35 00	36 05	37 09	38 14	39 19	40 24	42 07	44 04	36
40	39 44	40 32	41 20	42 24	43 12	44 32	45 52	47 12	48 32	49 52	52 00	54 24	40
44	48 04	49 03	50 01	51 18	52 17	53 54	55 30	57 07	58 44	60 21	62 55	65 49	44
48	57 13	58 22	59 31	61 03	62 12	64 07	66 01	67 56	69 53	. . .	. . .	. . .	48
52	67 09	68 30	69 51	71 39	73 00	. . .	. . .	. . .	. . .	. . .	. . .	. . .	52
56	77 52	79 27	81 01	83 06	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	56
60	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	. . .	60
	″	″	″	″	″	″	″	″	″	″	″	″	
Δ_1h	1.49	1.52	1.55	1.59	1.62	1.67	1.72	1.77	1.82	1.87	1.95	2.04	Δ_1h
Log.	0.173 19	0.181 84	0.190 33	0.201 40	0.209 52	0.222 72	0.235 53	0.247 97	0.260 07	0.271 84	0.290 03	0.309 63	Log.
Limit	47	46	45	44	43	42	41	40	39	38	37	36	Minutes
Meridian	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	73°	Altitudes

Latitude 64° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 34	0 35	0 36	0 38	0 41	0 43	0 46	0 51	0 55	1 02	1 10	1 21	4
8	2 15	2 21	2 27	2 35	2 43	2 54	3 06	3 22	3 42	4 06	4 39	5 26	8
12	5 05	5 17	5 30	5 47	6 07	6 32	6 59	7 35	8 19	9 14	10 28	12 13	12
16	9 03	9 23	9 46	10 17	10 53	11 36	12 25	13 29	14 45	16 26	18 36	21 43	16
20	14 08	14 40	15 16	16 04	17 00	18 08	19 24	21 04	23 04	25 40	29 04	33 56	20
24	20 22	21 07	21 59	23 08	24 29	26 07	27 56	30 21	33 13	36 58	...	...	24
28	27 42	28 45	29 56	31 30	33 19	35 33	38 02	41 17	...	...	...	...	28
32	36 10	37 33	39 05	41 08	43 31	46 25	49 40	...	...	...	...	...	32
36	45 48	47 31	49 28	52 03	55 05	...	...	...	...	...	...	...	36
40	56 32	58 40	61 04	...	...	...	...	...	...	...	...	...	40
44	68 25	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	2.12	2.20	2.29	2.41	2.55	2.72	2.91	3.16	3.46	3.85	4.36	5.09	$\Delta_1 h$
Log.	0.326 34	0.342 42	0.359 84	0.382 02	0.406 54	0.434 57	0.463 89	0.499 69	0.539 08	0.585 46	0.639 49	0.706 72	Log.
Limit	35	33	32	31	30	28	26	24	22	20	18	15	Minutes
Meridian	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	85°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	...	...	0 57	0 45	0 34	4
8	...	...	...	...	...	...	...	...	...	3 47	3 00	2 14	8
12	...	...	...	...	...	...	...	...	...	8 30	6 46	5 02	12
16	...	...	...	...	...	...	...	...	...	15 06	12 02	8 58	16
20	...	...	...	...	...	...	...	...	...	23 36	18 48	14 00	20
24	...	...	...	...	...	...	...	...	...	33 59	27 05	20 10	24
28	...	...	...	...	...	...	...	...	...	...	36 51	27 26	28
32	...	...	...	...	...	...	...	...	...	...	...	35 50	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	...	...	...	...	...	...	...	...	...	3.54	2.82	2.10	$\Delta_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.549 00	0.450 25	0.322 22	Log.
Limit	13	9	6	3	0	5	9	13	17	21	25	29	Minutes
Meridian	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	83°	Altitudes

Latitude 64° Declination Contrary Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 15	0 15	0 15	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	4
8	1 01	1 01	1 00	0 59	0 58	0 58	0 58	0 57	0 57	0 57	0 56	0 55	8
12	2 19	2 17	2 16	2 14	2 13	2 13	2 11	2 10	2 10	2 08	2 07	2 05	12
16	4 05	4 03	4 00	3 58	3 56	3 55	3 53	3 51	3 50	3 48	3 45	3 43	16
20	6 24	6 20	6 16	6 12	6 10	6 08	6 04	6 02	6 00	5 56	5 52	5 48	20
24	9 13	9 07	9 01	8 55	8 52	8 50	8 44	8 41	8 38	8 33	8 27	8 21	24
28	12 33	12 25	12 17	12 10	12 06	12 02	11 54	11 50	11 46	11 38	11 30	11 22	28
32	16 23	16 13	16 03	15 53	15 48	15 42	15 32	15 27	15 22	15 11	15 01	14 51	32
36	20 44	20 31	20 18	20 05	19 59	19 52	19 39	19 32	19 26	19 14	19 01	18 48	36
40	25 36	25 20	25 04	24 48	24 40	24 32	24 16	24 08	24 00	23 44	23 28	23 12	40
44	30 58	30 39	30 19	30 00	29 50	29 41	29 21	29 12	29 02	28 43	28 24	28 05	44
48	36 52	36 29	36 06	35 43	35 31	35 20	34 57	34 45	34 34	34 10	33 47	33 24	48
52	43 16	42 49	42 22	41 55	41 42	41 28	41 01	40 47	40 34	40 06	39 39	39 12	52
56	50 10	49 39	49 07	48 36	48 20	48 05	47 33	47 18	47 02	46 31	46 00	45 29	56
60	57 36	57 00	56 24	55 48	55 30	55 12	54 36	54 18	54 00	53 24	52 48	52 12	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.96	0.95	0.94	0.93	0.925	0.92	0.91	0.905	0.90	0.89	0.88	0.87	$\triangle_1$h
Log.	9.982 27	9.977 72	9.973 13	9.968 48	9.966 14	9.963 79	9.959 04	9.956 65	9.954 24	9.949 39	9.944 48	9.939 52	Log.
Limit	74	74	74	75	75	75	75	76	76	77	77	77	Minutes
Meridian	26°	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	0 14	0 14	0 14	0 13	0 13	0 13	0 13	0 13	0 13	0 12	4
8	0 55	0 55	0 54	0 54	0 54	0 53	0 52	0 52	0 51	0 51	0 51	0 51	8
12	2 04	2 04	2 02	2 01	2 01	1 59	1 58	1 58	1 56	1 55	1 55	1 54	12
16	3 42	3 40	3 38	3 36	3 35	3 33	3 31	3 30	3 28	3 26	3 25	3 22	16
20	5 46	5 44	5 40	5 38	5 36	5 32	5 30	5 28	5 24	5 22	5 20	5 16	20
24	8 18	8 16	8 10	8 07	8 04	7 58	7 56	7 53	7 47	7 44	7 41	7 35	24
28	11 18	11 14	11 06	11 02	10 58	10 51	10 47	10 43	10 35	10 31	10 27	10 20	28
32	14 45	14 40	14 30	14 25	14 20	14 10	14 05	13 59	13 49	13 44	13 39	13 29	32
36	18 42	18 35	18 22	18 16	18 09	17 56	17 50	17 43	17 30	17 24	17 17	17 04	36
40	23 04	22 56	22 40	22 32	22 24	22 08	22 00	21 52	21 36	21 28	21 20	21 04	40
44	27 55	27 45	27 26	27 16	27 06	26 47	26 37	26 28	26 08	25 59	25 49	25 29	44
48	33 12	33 01	32 38	32 27	32 15	31 52	31 40	31 29	31 06	30 54	30 43	30 18	48
52	38 59	38 45	38 18	38 05	37 51	37 24	37 10	36 57	36 30	36 17	36 03	35 36	52
56	45 13	44 57	44 26	44 10	43 54	43 23	43 08	42 52	42 20	42 05	41 49	41 17	56
60	51 54	51 36	51 00	50 42	50 24	49 48	49 30	49 12	48 36	48 18	48 00	47 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.865	0.86	0.85	0.845	0.84	0.83	0.825	0.82	0.81	0.805	0.80	0.79	$\triangle_1$h
Log.	9.937 02	9.934 50	9.929 42	9.926 86	9.924 28	9.919 08	9.916 45	9.913 81	9.908 49	9.905 80	9.903 09	9.897 63	Log.
Limit	77	78	78	78	78	79	80	80	81	81	81	82	Minutes
Meridian	14°	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	Altitudes

Latitude 64° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	...	0 12	0 12	0 12	0 11	0 11	4
8	...	...	...	...	...	...	...	0 48	0 47	0 47	0 46	0 46	8
12	...	...	...	...	...	...	...	1 47	1 45	1 45	1 44	1 43	12
16	...	...	...	...	...	...	...	3 09	3 07	3 06	3 04	3 03	16
20	...	...	...	...	...	...	...	4 56	4 52	4 50	4 48	4 46	20
24	...	...	...	...	...	...	...	7 06	7 00	6 57	6 55	6 52	24
28	...	...	...	...	...	...	...	9 40	9 33	9 29	9 25	9 21	28
32	...	...	...	...	...	...	...	12 38	12 28	12 22	12 17	12 12	32
36	...	...	...	...	...	...	...	15 59	15 46	15 40	15 33	15 26	36
40	...	...	...	...	...	...	...	19 44	19 28	19 20	19 12	19 04	40
44	...	...	...	...	...	...	...	23 52	23 33	23 23	23 14	23 04	44
48	...	...	...	...	...	...	...	28 23	28 00	27 49	27 37	27 26	48
52	...	...	...	...	...	...	...	33 21	32 54	32 40	32 27	32 13	52
56	...	...	...	...	...	...	...	38 40	38 09	37 53	37 38	37 22	56
60	...	...	...	...	...	...	...	44 24	43 48	43 30	43 12	42 54	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	...	0.74	0.73	0.725	0.72	0.715	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	... ...	9.869 23	9.863 32	9.860 34	9.857 33	9.854 31	Log.
Limit								107	107	107	107	107	Minutes
Meridian	2°	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	4
8	0 45	0 45	0 44	0 44	0 43	0 43	0 42	0 42	0 42	0 41	0 41	0 41	8
12	1 41	1 41	1 39	1 39	1 38	1 36	1 35	1 35	1 33	1 32	1 31	1 30	12
16	3 00	2 59	2 57	2 55	2 54	2 52	2 50	2 49	2 47	2 44	2 43	2 42	16
20	4 42	4 40	4 36	4 34	4 32	4 28	4 26	4 24	4 20	4 16	4 14	4 12	20
24	6 46	6 43	6 38	6 35	6 32	6 26	6 24	6 21	6 15	6 09	6 06	6 03	24
28	9 13	9 09	9 01	8 56	8 53	8 45	8 41	8 37	8 29	8 21	8 17	8 14	28
32	12 02	11 57	11 46	11 41	11 36	11 26	11 20	11 15	11 05	10 55	10 50	10 45	32
36	15 14	15 07	14 55	14 48	14 42	14 29	14 23	14 16	14 03	13 50	13 43	13 37	36
40	18 48	18 40	18 24	18 16	18 08	17 52	17 44	17 36	17 20	17 04	16 56	16 48	40
44	22 44	22 35	22 16	22 07	21 57	21 38	21 28	21 18	20 59	20 39	20 29	20 20	44
48	27 02	26 51	26 29	26 18	26 08	25 43	25 32	25 20	24 57	24 34	24 23	24 11	48
52	31 46	31 33	31 05	30 51	30 38	30 11	29 57	29 44	29 17	28 50	28 37	28 23	52
56	36 51	36 35	36 04	35 48	35 33	35 02	34 46	34 30	33 59	33 27	33 12	32 56	56
60	42 18	42 00	41 24	41 06	40 48	40 12	39 54	39 36	39 00	38 24	38 06	37 48	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.705	0.70	0.69	0.685	0.68	0.67	0.665	0.66	0.65	0.64	0.635	0.63	$\triangle_1 h$
Log.	9.848 19	9.845 10	9.838 85	9.835 69	9.832 51	9.826 07	9.822 82	9.819 54	9.812 91	9.806 18	9.802 77	9.799 34	Log.
Limit	107	107	107	107	107	107	107	107	107	107	107	107	Minutes
Meridian	10°	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	Altitudes

Latitude 64° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 10	0 10	0 10	0 10	0 09	0 09	0 09	0 09	0 09	0 09	0 09	0 09	4
8	0 40	0 40	0 39	0 38	0 38	0 38	0 37	0 36	0 36	0 35	0 35	0 33	8
12	1 29	1 27	1 26	1 26	1 25	1 24	1 23	1 21	1 20	1 19	1 17	1 16	12
16	2 39	2 37	2 36	2 34	2 31	2 28	2 26	2 23	2 22	2 20	2 17	2 15	16
20	4 08	4 04	4 02	4 00	3 56	3 52	3 50	3 44	3 42	3 38	3 34	3 30	20
24	5 58	5 52	5 49	5 46	5 40	5 34	5 31	5 23	5 20	5 14	5 08	5 03	24
28	8 06	7 58	7 54	7 50	7 43	7 35	7 31	7 19	7 15	7 07	7 00	6 52	28
32	10 34	10 24	10 19	10 14	10 04	9 54	9 49	9 33	9 28	9 18	9 08	8 57	32
36	13 24	13 11	13 05	12 58	12 45	12 32	12 26	12 06	12 00	11 46	11 34	11 20	36
40	16 32	16 16	16 08	16 00	15 44	15 28	15 20	14 56	14 48	14 32	14 16	14 00	40
44	20 01	19 41	19 31	19 22	19 02	18 43	18 34	18 04	17 54	17 35	17 15	16 56	44
48	23 48	23 25	23 14	23 02	22 39	22 16	22 05	21 30	21 18	20 56	20 33	20 10	48
52	27 56	27 29	27 15	27 02	26 35	26 08	25 55	25 14	25 00	24 34	24 06	23 40	52
56	32 25	31 53	31 37	31 22	30 50	30 19	30 03	29 16	29 00	28 28	27 58	27 27	56
60	37 12	36 36	36 18	36 00	35 24	34 48	34 30	33 36	33 18	32 42	32 06	31 30	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.62	0.61	0.605	0.60	0.59	0.58	0.575	0.56	0.555	0.545	0.535	0.525	$\triangle_1$h
Log.	9.792 39	9.785 33	9.781 76	9.778 15	9.770 85	9.763 43	9.759 67	9.748 19	9.744 29	9.736 40	9.728 35	9.720 16	Log.
Limit	107	107	107	107	107	107	107	107	107	107	107	107	Minutes
Meridian	22°	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 09	0 09	0 08	0 08	0 08	0 07	0 07	0 07	0 07	0 06	0 06	0 06	4
8	0 33	0 32	0 32	0 31	0 31	0 31	0 29	0 29	0 28	0 27	0 26	0 26	8
12	1 15	1 13	1 12	1 11	1 09	1 08	1 06	1 04	1 02	1 01	0 59	0 58	12
16	2 13	2 11	2 08	2 05	2 03	2 00	1 56	1 54	1 50	1 47	1 45	1 42	16
20	3 28	3 24	3 20	3 16	3 12	3 08	3 02	2 58	2 52	2 48	2 44	2 40	20
24	5 00	4 54	4 48	4 42	4 36	4 30	4 22	4 16	4 07	4 02	3 56	3 50	24
28	6 48	6 40	6 32	6 25	6 16	6 09	5 57	5 49	5 38	5 30	5 22	5 14	28
32	8 52	8 42	8 32	8 22	8 12	8 02	7 46	7 36	7 21	7 10	7 00	6 50	32
36	11 14	11 01	10 48	10 35	10 22	10 09	9 49	9 36	9 17	9 04	8 51	8 38	36
40	13 52	13 36	13 20	13 04	12 48	12 32	12 08	11 52	11 28	11 12	10 56	10 40	40
44	16 47	16 27	16 08	15 48	15 29	15 10	14 41	14 21	13 52	13 33	13 13	12 54	44
48	19 58	19 35	19 12	18 49	18 26	18 03	17 29	17 05	16 31	16 08	15 45	15 22	48
52	23 26	22 59	22 32	22 05	21 35	21 11	20 31	20 04	19 23	18 56	18 29	18 02	52
56	27 11	26 39	26 08	25 36	25 05	24 34	23 46	23 15	22 28	21 57	21 25	20 54	56
60	31 12	30 36	30 00	29 24	28 18	28 12	27 18	26 42	25 48	25 12	24 36	24 00	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.52	0.51	0.50	0.49	0.48	0.47	0.455	0.445	0.43	0.42	0.41	0.40	$\triangle_1$h
Log.	9.716 00	9.707 57	9.698 97	9.690 20	9.681 24	9.672 10	9.658 01	9.648 36	9.633 47	9.623 25	9.612 78	9.602 06	Log.
Limit	107	107	107	107	107	107	107	107	107	107	107	107	Minutes
Meridian	34°	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	Altitudes

Latitude 65° Declination Same Name.

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	0 14	0 14	0 15	0 15	0 15	0 15	0 15	0 15	0 16	0 16	4
8	0 58	0 58	0 58	0 59	1 00	1 01	1 01	1 02	1 02	1 03	1 04	1 04	8
12	2 11	2 13	2 13	2 14	2 16	2 17	2 19	2 20	2 22	2 23	2 24	2 25	12
16	3 53	3 55	3 56	3 58	4 00	4 03	4 05	4 08	4 10	4 13	4 16	4 19	16
20	6 04	6 08	6 10	6 12	6 16	6 20	6 24	6 28	6 32	6 36	6 40	6 44	20
24	8 44	8 50	8 53	8 55	9 01	9 07	9 13	9 18	9 24	9 30	9 36	9 42	24
28	11 54	12 02	12 06	12 10	12 17	12 25	12 33	12 41	12 49	12 57	13 04	13 12	28
32	15 32	15 42	15 48	15 53	16 03	16 13	16 23	16 34	16 44	16 54	17 04	17 14	32
36	19 39	19 52	19 59	20 05	20 18	20 31	20 44	20 57	21 10	21 23	21 36	21 49	36
40	24 16	24 32	24 40	24 48	25 04	25 20	25 36	25 52	26 08	26 24	26 40	26 56	40
44	29 21	29 41	29 50	30 00	30 19	30 39	30 58	31 18	31 37	31 56	32 16	32 35	44
48	34 57	35 20	35 31	35 43	36 06	36 29	36 52	37 15	37 38	38 01	38 24	38 47	48
52	41 01	41 28	41 42	41 55	42 22	42 49	43 16	43 43	44 10	44 37	45 04	45 31	52
56	47 33	48 05	48 20	48 36	49 07	49 39	50 10	50 42	51 13	51 44	52 16	52 47	56
60	54 36	55 12	55 30	55 48	56 24	57 00	57 36	58 12	58 48	59 24	60 00	60 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	0.91	0.92	0.925	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.01	$\triangle_1$h
Log.	9.959 04	9.963 79	9.966 14	9.968 48	9.973 13	9.977 72	9.982 27	9.986 77	9.991 23	9.995 64	0.00 ...	0.004 32	Log.
Limit	73	72	71	70	69	69	69	68	68	67	67	66	Minutes
Meridian	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	36°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 16	0 16	0 16	0 17	0 17	0 17	0 17	0 17	0 18	0 18	0 18	0 19	4
8	1 04	1 05	1 06	1 07	1 07	1 08	1 09	1 10	1 10	1 11	1 12	1 13	8
12	2 25	2 27	2 28	2 30	2 31	2 33	2 36	2 37	2 38	2 39	2 42	2 44	12
16	4 19	4 21	4 24	4 26	4 29	4 31	4 36	4 39	4 42	4 45	4 50	4 52	16
20	6 44	6 48	6 52	6 56	7 00	7 04	7 12	7 16	7 20	7 24	7 32	7 36	20
24	9 42	9 48	9 53	9 59	10 05	10 11	10 22	10 28	10 34	10 40	10 51	10 57	24
28	13 12	13 20	13 28	13 35	13 43	13 51	14 07	14 15	14 22	14 30	14 46	14 53	28
32	17 14	17 24	17 35	17 45	17 55	18 05	18 26	18 36	18 46	18 56	19 17	19 27	32
36	21 49	22 02	22 15	22 28	22 41	22 54	23 20	23 33	23 46	23 59	24 25	24 38	36
40	26 56	27 12	27 28	27 44	28 00	28 16	28 48	29 04	29 20	29 36	30 08	30 24	40
44	32 35	32 55	33 14	33 33	33 53	34 12	34 51	35 10	35 30	35 49	36 28	36 47	44
48	38 47	39 10	39 33	39 56	40 19	40 42	41 28	41 51	42 14	42 37	43 23	43 46	48
52	45 31	45 58	46 25	46 52	47 19	47 46	48 40	49 07	49 34	50 01	50 55	51 22	52
56	52 47	53 19	53 50	54 21	54 53	55 24	56 27	56 58	57 30	58 01	59 04	59 35	56
60	60 36	61 12	61 48	62 24	63 00	63 36	64 48	65 24	66 00	66 36	67 48	68 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.015	1.02	1.03	1.04	1.05	1.06	1.08	1.09	1.10	1.11	1.13	1.14	$\triangle_1$h
Log.	0.006 47	0.008 60	0.012 84	0.017 03	0.021 19	0.025 31	0.033 42	0.037 43	0.041 39	0.045 32	0.053 08	0.056 90	Log.
Limit	65	65	64	64	63	63	62	62	61	61	60	59	Minutes
Meridian	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	48°	Altitudes

DECLINATIONS.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 19	0 19	0 19	0 19	0 19	0 20	0 20	0 20	0 21	0 21	0 22	0 22	4
8	1 14	1 15	1 16	1 17	1 18	1 20	1 20	1 21	1 23	1 24	1 26	1 27	8
12	2 47	2 48	2 51	2 53	2 56	2 59	3 00	3 03	3 07	3 10	3 13	3 16	12
16	4 57	5 00	5 05	5 07	5 12	5 17	5 20	5 25	5 33	5 38	5 43	5 48	16
20	7 44	7 48	7 56	8 00	8 08	8 16	8 20	8 28	8 40	8 48	8 56	9 04	20
24	11 09	11 14	11 26	11 31	11 43	11 54	12 00	12 11	12 29	12 41	12 52	13 04	24
28	15 09	15 17	15 33	15 41	15 57	16 12	16 20	16 36	16 59	17 15	17 30	17 46	28
32	19 47	19 58	20 18	20 29	20 49	21 10	21 20	21 41	22 11	22 31	22 52	23 12	32
36	25 04	25 17	25 43	25 55	26 21	26 47	27 00	27 26	28 05	28 31	28 57	29 23	36
40	30 56	31 12	31 44	32 00	32 32	33 04	33 20	33 52	34 40	35 12	35 44	36 16	40
44	37 26	37 46	38 24	38 43	39 22	40 00	40 20	40 59	41 57	42 36	43 14	43 53	44
48	44 32	44 55	45 41	46 05	46 51	47 37	48 00	48 46	49 55	50 41	51 27	52 13	48
52	52 16	52 43	53 37	54 05	54 59	55 53	56 20	57 14	58 35	59 29	60 23	61 17	52
56	60 38	61 10	62 12	62 43	63 46	64 48	65 20	66 23	67 57	69 00	70 02	71 05	56
60	69 36	70 12	71 24	72 00	73 12	74 24	75 00	76 12	78 00	79 12	80 24	81 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.16	1.17	1.19	1.20	1.22	1.24	1.25	1.27	1.30	1.32	1.34	1.36	$\triangle_1$h
Log.	0.064 46	0.068 19	0.075 55	0.079 18	0.086 36	0.093 42	0.096 91	0.103 80	0.113 94	0.120 57	0.127 10	0.133 54	Log
Limit	57	57	56	55	54	53	53	52	51	50	49	49	Minutes
Meridian	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	60°	Altitudes

DECLINATIONS.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 22	0 22	0 23	0 23	0 24	0 25	0 25	0 26	0 27	0 27	0 28	0 30	4
8	1 29	1 31	1 33	1 35	1 36	1 39	1 42	1 44	1 47	1 50	1 54	1 58	8
12	3 20	3 25	3 29	3 34	3 36	3 43	3 49	3 54	4 00	4 08	4 17	4 26	12
16	5 56	6 03	6 11	6 18	6 24	6 37	6 47	6 58	7 08	7 20	7 35	7 54	16
20	9 16	9 28	9 40	9 52	10 00	10 20	10 36	10 52	11 08	11 28	11 52	12 20	20
24	13 21	13 38	13 55	14 12	14 24	14 53	15 16	15 39	16 02	16 31	17 05	17 46	24
28	18 10	18 34	18 57	19 21	19 36	20 15	20 47	21 18	21 49	22 29	23 16	24 10	28
32	23 43	24 14	24 45	25 16	25 36	26 27	27 08	27 49	28 30	29 21	30 23	31 34	32
36	30 02	30 40	31 19	31 58	32 24	33 29	34 21	35 13	36 05	37 09	38 27	39 58	36
40	37 04	37 52	38 40	39 28	40 00	41 20	42 24	43 28	44 32	45 52	47 28	49 20	40
44	44 51	45 49	46 47	47 45	48 24	50 01	51 18	52 36	53 54	55 30	57 26	59 42	44
48	53 22	54 32	55 41	56 50	57 36	59 31	61 03	62 35	64 07	66 01	...	...	48
52	62 38	64 00	65 21	66 42	67 36	69 51	...	...	...	...	...	...	52
56	72 39	74 13	75 37	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1$h	1.39	1.42	1.45	1.48	1.50	1.55	1.59	1.63	1.67	1.72	1.78	1.85	$\triangle_1$h
Log.	0.143 01	0.152 29	0.161 37	0.170 26	0.176 09	0.190 33	0.201 40	0.212 19	0.222 72	0.235 53	0.250 42	0.267 17	Log.
Limit	48	47	46	45	44	43	42	41	40	39	38	37	Minutes
Meridian	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	72°	Altitudes

Latitude 65° Declination Same Name.

DECLINATIONS.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 30	0 31	0 33	0 35	0 36	0 38	0 41	0 44	0 47	0 52	0 58	1 05	4
8	2 02	2 07	2 12	2 17	2 26	2 34	2 44	2 56	3 10	3 28	3 51	4 22	8
12	4 37	4 47	4 57	5 09	5 27	5 46	6 09	6 35	7 08	7 48	8 39	9 49	12
16	8 11	8 29	8 47	9 11	9 41	10 14	10 55	11 41	12 40	13 52	15 25	17 27	16
20	12 48	13 16	13 44	14 20	15 08	16 00	17 04	18 16	19 48	21 40	24 04	27 16	20
24	18 26	19 06	19 47	20 39	21 47	23 02	24 35	26 18	28 30	31 12	34 40	...	24
28	25 06	26 01	26 55	28 05	29 40	31 22	33 27	35 48	38 49	42 28	...	...	28
32	32 46	33 58	35 09	36 41	38 45	40 58	43 41	46 46	...	...	...	...	32
36	41 28	42 59	44 30	46 27	49 02	51 50	...	...	...	...	...	...	36
40	51 12	53 04	54 56	57 20	60 32	...	...	...	...	...	...	...	40
44	61 57	64 12	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	1.92	1.99	2.06	2.15	2.27	2.40	2.56	2.74	2.97	3.25	3.61	4.09	$\Delta_1 h$
Log.	0.283 30	0.298 85	0.313 87	0.332 44	0.356 03	0.380 21	0.408 24	0.437 75	0.472 76	0.511 88	0.557 51	0.611 72	Log.
Limit	36	35	34	33	32	30	28	26	24	22	20	18	Minutes
Meridian	73°	74°	75°	76°	77°	78°	79°	80°	81°	82°	83°	84°	Altitudes

DECLINATIONS.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	1 16	...	...	...	...	...	...	...	...	...	0 52	0 41	4
8	5 05	...	...	...	...	...	...	...	...	...	3 28	2 46	8
12	11 26	...	...	...	...	...	...	...	...	...	7 48	6 13	12
16	20 18	...	...	...	...	...	...	...	...	...	13 52	11 03	16
20	...	...	...	...	...	...	...	...	...	...	21 40	17 16	20
24	...	...	...	...	...	...	...	...	...	...	...	24 52	24
28	...	...	...	...	...	...	...	...	...	...	...	...	28
32	...	...	...	...	...	...	...	...	...	...	...	...	32
36	...	...	...	...	...	...	...	...	...	...	...	...	36
40	...	...	...	...	...	...	...	...	...	...	...	...	40
44	...	...	...	...	...	...	...	...	...	...	...	...	44
48	...	...	...	...	...	...	...	...	...	...	...	...	48
52	...	...	...	...	...	...	...	...	...	...	...	...	52
56	...	...	...	...	...	...	...	...	...	...	...	...	56
60	...	...	...	...	...	...	...	...	...	...	...	...	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	4.76	...	...	...	...	...	...	...	...	...	3.25	2.59	$\Delta_1 h$
Log.	0.677 61	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	... ...	0.511 88	0.413 30	Log.
Limit	16	12	9	6	3	0	5	8	10	12	14	16	Minutes
Meridian	85°	86°	87°	88°	89°	90°	89°	88°	87°	86°	85°	84°	Altitudes

DECLINATIONS.

Hour Angles	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	11°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	0 14	4
8	0 58	0 57	0 57	0 57	0 56	0 56	0 55	0 55	0 54	0 54	0 54	0 54	8
12	2 11	2 10	2 10	2 08	2 07	2 07	2 05	2 04	2 03	2 02	2 01	2 00	12
16	3 53	3 51	3 50	3 48	3 46	3 45	3 43	3 40	3 39	3 38	3 35	3 33	16
20	6 04	6 02	6 00	5 56	5 54	5 52	5 48	5 44	5 42	5 40	5 36	5 34	20
24	8 44	8 41	8 38	8 33	8 30	8 27	8 21	8 16	8 13	8 10	8 04	8 01	24
28	11 54	11 50	11 46	11 38	11 34	11 30	11 22	11 14	11 10	11 06	10 58	10 54	28
32	15 32	15 27	15 22	15 11	15 06	15 01	14 51	14 40	14 35	14 30	14 20	14 15	32
36	19 39	19 31	19 26	19 14	19 07	19 01	18 48	18 35	18 28	18 22	18 09	18 03	36
40	24 16	24 08	24 00	23 44	23 36	23 28	23 12	22 56	22 48	22 40	22 24	22 16	40
44	29 21	29 12	29 02	28 43	28 34	28 24	28 05	27 45	27 36	27 26	27 06	26 56	44
48	34 57	34 45	34 34	34 10	33 59	33 47	33 24	33 01	32 50	32 38	32 15	32 03	48
52	41 01	40 47	40 34	40 06	39 52	39 39	39 12	38 45	38 31	38 18	37 51	37 38	52
56	47 33	47 18	47 02	46 31	46 15	46 00	45 29	44 57	44 42	44 26	43 54	43 39	56
60	54 36	54 18	54 00	53 24	53 06	52 48	52 12	51 36	51 18	51 00	50 24	50 06	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.91	0.905	0.90	0.89	0.885	0.88	0.87	0.86	0.855	0.85	0.84	0.835	$\Delta_1 h$
Log.	9.959 04	9.956 65	9.954 24	9.949 39	9.946 94	9.944 48	9.939 52	9.934 50	9.931 97	9.929 42	9.924 28	9.921 69	Log.
Limit	76	76	76	77	77	77	77	77	78	78	78	78	Minutes
Meridian	25°	24°	23°	22°	21°	20°	19°	18°	17°	16°	15°	14°	Altitudes

DECLINATIONS.

Hour Angles	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	23°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 13	0 13	0 13	0 13	0 13	0 13	0 12	0 12	0 12	0 12	0 12	0 12	4
8	0 53	0 52	0 52	0 51	0 51	0 51	0 51	0 50	0 50	0 50	0 50	0 50	8
12	1 59	1 58	1 58	1 56	1 55	1 55	1 54	1 53	1 52	1 51	1 51	1 50	12
16	3 33	3 31	3 30	3 28	3 26	3 25	3 22	3 21	3 19	3 18	3 17	3 16	16
20	5 32	5 30	5 28	5 24	5 22	5 20	5 16	5 14	5 12	5 10	5 08	5 06	20
24	7 58	7 55	7 53	7 47	7 44	7 41	7 35	7 32	7 29	7 26	7 23	7 20	24
28	10 51	10 47	10 43	10 35	10 31	10 27	10 20	10 16	10 12	10 08	10 04	10 00	28
32	14 10	14 05	13 59	13 49	13 44	13 39	13 29	13 24	13 19	13 14	13 09	13 04	32
36	17 56	17 50	17 43	17 30	17 24	17 17	17 04	16 57	16 51	16 44	16 38	16 32	36
40	22 08	22 00	21 52	21 36	21 28	21 20	21 04	20 56	20 48	20 40	20 32	20 24	40
44	26 47	26 37	26 28	26 08	25 59	25 49	25 29	25 20	25 10	25 00	24 51	24 42	44
48	31 52	31 40	31 29	31 06	30 54	30 43	30 18	30 07	29 55	29 44	29 32	29 20	48
52	37 24	37 10	36 57	36 30	36 17	36 03	35 36	35 23	35 09	34 55	34 42	34 18	52
56	43 23	43 08	42 52	42 20	42 05	41 49	41 17	41 02	40 46	40 30	40 15	40 00	56
60	49 48	49 30	49 12	48 36	48 18	48 00	47 24	47 06	46 48	46 30	46 12	45 54	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\Delta_1 h$	0.83	0.825	0.82	0.81	0.805	0.80	0.79	0.785	0.78	0.775	0.77	0.765	$\Delta_1 h$
Log.	9.919 08	9.916 45	9.913 81	9.908 49	9.905 80	9.903 09	9.897 63	9.894 87	9.892 09	9.889 30	9.886 49	9.883 66	Log.
Limit	78	79	79	79	80	80	81	81	81	82	82	83	Minutes
Meridian	13°	12°	11°	10°	9°	8°	7°	6°	5°	4°	3°	2°	Altitudes

Latitude 65° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	35°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	...	...	...	...	...	...	0 11	0 11	0 11	0 11	0 11	0 11	4
8	...	...	...	...	...	...	0 46	0 46	0 46	0 45	0 44	0 44	8
12	...	...	...	...	...	...	1 44	1 43	1 42	1 41	1 40	1 39	12
16	...	...	...	...	...	...	3 04	3 03	3 02	2 59	2 58	2 57	16
20	...	...	...	...	...	...	4 48	4 46	4 44	4 40	4 38	4 36	20
24	...	...	...	...	...	...	6 55	6 52	6 49	6 43	6 40	6 38	24
28	...	...	...	...	...	...	9 25	9 21	9 17	9 09	9 05	9 01	28
32	...	...	...	...	...	...	12 17	12 12	12 07	11 57	11 51	11 46	32
36	...	...	...	...	...	...	15 33	15 26	15 20	15 07	15 01	14 55	36
40	...	...	...	...	...	...	19 12	19 04	18 56	18 40	18 32	18 24	40
44	...	...	...	...	...	...	23 14	23 04	22 54	22 35	22 26	22 16	44
48	...	...	...	...	...	...	27 37	27 25	27 14	26 51	26 40	26 29	48
52	...	...	...	...	...	...	32 27	32 14	32 00	31 33	31 19	31 05	52
56	...	...	...	...	...	...	37 38	37 22	37 06	36 35	36 20	36 04	56
60	...	...	...	...	...	...	43 12	42 54	42 36	42 00	41 42	41 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	...	...	...	...	...	...	0.72	0.715	0.71	0.70	0.695	0.69	$\triangle_1 h$
Log.	... ...	... ...	... ...	... ...	... ...	... ...	9.857 33	9.854 31	9.851 26	9.845 10	9.841 98	9.838 85	Log.
Limit							110	110	110	110	110	110	Minutes
Meridian	1°	0°	1°	2°	3°	4°	5°	6°	7°	8°	9°	10°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	47°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 11	0 10	0 10	0 10	0 10	4
8	0 44	0 43	0 43	0 43	0 43	0 43	0 40	0 40	0 40	0 40	0 40	0 40	8
12	1 39	1 37	1 36	1 35	1 35	1 33	1 32	1 32	1 30	1 30	1 29	1 27	12
16	2 55	2 53	2 52	2 50	2 49	2 47	2 45	2 44	2 42	2 41	2 39	2 37	16
20	4 34	4 30	4 28	4 26	4 24	4 20	4 18	4 16	4 12	4 10	4 08	4 04	20
24	6 35	6 29	6 26	6 24	6 21	6 15	6 12	6 09	6 03	6 00	5 58	5 52	24
28	8 56	8 49	8 45	8 41	8 37	8 29	8 25	8 21	8 14	8 10	8 06	7 58	28
32	11 41	11 31	11 26	11 20	11 15	11 05	11 00	10 55	10 45	10 39	10 34	10 24	32
36	14 48	14 35	14 29	14 22	14 16	14 03	13 56	13 50	13 37	13 30	13 24	13 11	36
40	18 16	18 00	17 52	17 44	17 36	17 20	17 12	17 04	16 48	16 40	16 32	16 16	40
44	22 07	21 48	21 38	21 28	21 18	20 59	20 49	20 39	20 20	20 10	20 01	19 41	44
48	26 18	25 54	25 43	25 31	25 20	24 57	24 45	24 34	24 11	24 00	23 48	23 25	48
52	30 51	30 24	30 11	29 57	29 44	29 17	29 03	28 50	28 23	28 10	27 56	27 29	52
56	35 48	35 18	35 02	34 46	34 30	33 59	33 44	33 27	32 56	32 40	32 25	31 53	56
60	41 06	40 30	40 12	39 54	39 36	39 00	38 42	38 24	37 48	37 30	37 12	36 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
$\triangle_1 h$	0.685	0.675	0.67	0.665	0.66	0.65	0.645	0.64	0.63	0.625	0.62	0.61	$\triangle_1 h$
Log.	9.835 69	9.829 30	9.826 07	9.822 82	9.819 54	9.812 91	9.809 56	9.806 18	9.799 34	9.795 88	9.792 39	9.785 33	Log.
Limit	110	110	110	110	110	110	110	110	110	110	110	110	Minutes
Meridian	11°	12°	13°	14°	15°	16°	17°	18°	19°	20°	21°	22°	Altitudes

Latitude 65° Declination Contrary Name.

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	48°	49°	50°	51°	52°	53°	54°	55°	56°	57°	58°	59°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 10	0 10	0 09	0 09	0 09	0 09	0 09	0 09	0 09	0 09	0 09	0 08	4
8	0 39	0 39	0 38	0 38	0 37	0 37	0 37	0 36	0 35	0 34	0 33	0 32	8
12	1 26	1 26	1 25	1 24	1 22	1 22	1 21	1 19	1 18	1 16	1 15	1 13	12
16	2 34	2 33	2 31	2 28	2 26	2 24	2 23	2 21	2 18	2 16	2 13	2 11	16
20	4 00	3 58	3 56	3 52	3 48	3 46	3 44	3 40	3 36	3 32	3 28	3 24	20
24	5 46	5 43	5 40	5 34	5 28	5 26	5 23	5 17	5 11	5 05	5 00	4 54	24
28	7 50	7 46	7 43	7 35	7 27	7 23	7 19	7 11	7 03	6 56	6 48	6 40	28
32	10 14	10 09	10 04	9 54	9 44	9 38	9 33	9 23	9 13	9 03	8 52	8 42	32
36	12 58	12 52	12 45	12 32	12 19	12 12	12 06	11 53	11 40	11 27	11 14	11 01	36
40	16 00	15 52	15 44	15 28	15 12	15 04	14 56	14 40	14 24	14 08	13 52	13 36	40
44	19 22	19 12	19 02	18 43	18 24	18 14	18 04	17 45	17 25	17 06	16 47	16 27	44
48	23 02	22 50	22 39	22 16	21 53	21 42	21 30	21 07	20 44	20 21	19 58	19 35	48
52	27 02	26 48	26 35	26 08	25 41	25 27	25 14	24 47	24 20	23 53	23 26	22 59	52
56	31 22	31 06	30 50	30 19	29 48	29 32	29 16	28 45	28 13	27 42	27 11	26 39	56
60	36 00	35 42	35 24	34 48	34 12	33 54	33 36	33 00	32 24	31 48	31 12	30 36	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	0.60	0.595	0.59	0.58	0.57	0.565	0.56	0.55	0.54	0.53	0.52	0.51	△₁h
Log.	9.778 15	9.774 52	9.770 85	9.763 43	9.755 87	9.752 05	9.748 19	9.740 36	9.732 39	9.724 28	9.716 00	9.707 57	Log.
Limit	110	110	110	110	110	110	110	110	110	110	110	110	Minutes
Meridian	23°	24°	25°	26°	27°	28°	29°	30°	31°	32°	33°	34°	Altitudes

DECLINATIONS. — INFERIOR MERIDIAN.

Hour Angles	60°	61°	62°	63°	64°	65°	66°	67°	68°	69°	70°	71°	Hour Angles
Min.	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	′ ″	Min.
4	0 08	0 08	0 08	0 08	0 07	0 07	0 07	0 07	0 06	0 06	0 06	0 06	4
8	0 32	0 32	0 32	0 31	0 30	0 30	0 29	0 28	0 27	0 26	0 26	0 25	8
12	1 13	1 12	1 11	1 09	1 08	1 07	1 05	1 02	1 01	0 59	0 58	0 57	12
16	2 10	2 08	2 05	2 03	2 00	1 57	1 55	1 50	1 47	1 45	1 42	1 39	16
20	3 22	3 20	3 16	3 12	3 08	3 04	3 00	2 52	2 48	2 44	2 40	2 36	20
24	4 51	4 48	4 42	4 36	4 30	4 25	4 19	4 07	4 02	3 56	3 50	3 44	24
28	6 36	6 32	6 25	6 16	6 09	6 01	5 53	5 38	5 30	5 22	5 14	5 06	28
32	8 37	8 32	8 22	8 12	8 02	7 51	7 41	7 21	7 10	7 00	6 50	6 40	32
36	10 54	10 48	10 35	10 22	10 09	9 56	9 43	9 17	9 04	8 51	8 38	8 25	36
40	13 28	13 20	13 04	12 48	12 32	12 16	12 00	11 28	11 12	10 56	10 40	10 24	40
44	16 18	16 08	15 48	15 29	15 10	14 50	14 31	13 52	13 33	13 13	12 54	12 35	44
48	19 24	19 12	18 49	18 26	18 03	17 40	17 17	16 31	16 08	15 45	15 22	15 00	48
52	22 45	22 32	22 05	21 38	21 11	20 44	20 17	19 23	18 56	18 29	18 02	17 35	52
56	26 24	26 08	25 36	25 05	24 34	24 04	23 31	22 28	21 57	21 25	20 54	20 23	56
60	30 18	30 00	19 24	28 48	28 12	27 36	27 00	25 48	25 12	24 36	24 00	23 24	60
	″	″	″	″	″	″	″	″	″	″	″	″	
△₁h	0.505	0.50	0.49	0.48	0.47	0.46	0.45	0.435	0.42	0.41	0.40	0.39	△₁h
Log.	9.703 29	9.698 97	9.690 20	9.681 24	9.672 10	9.662 76	9.653 21	9.638 49	9.623 25	9.612 78	9.602 06	9.591 06	Log.
Limit	110	110	110	110	110	110	110	110	110	110	110	110	Minutes
Meridian	35°	36°	37°	38°	39°	40°	41°	42°	43°	44°	45°	46°	Altitudes

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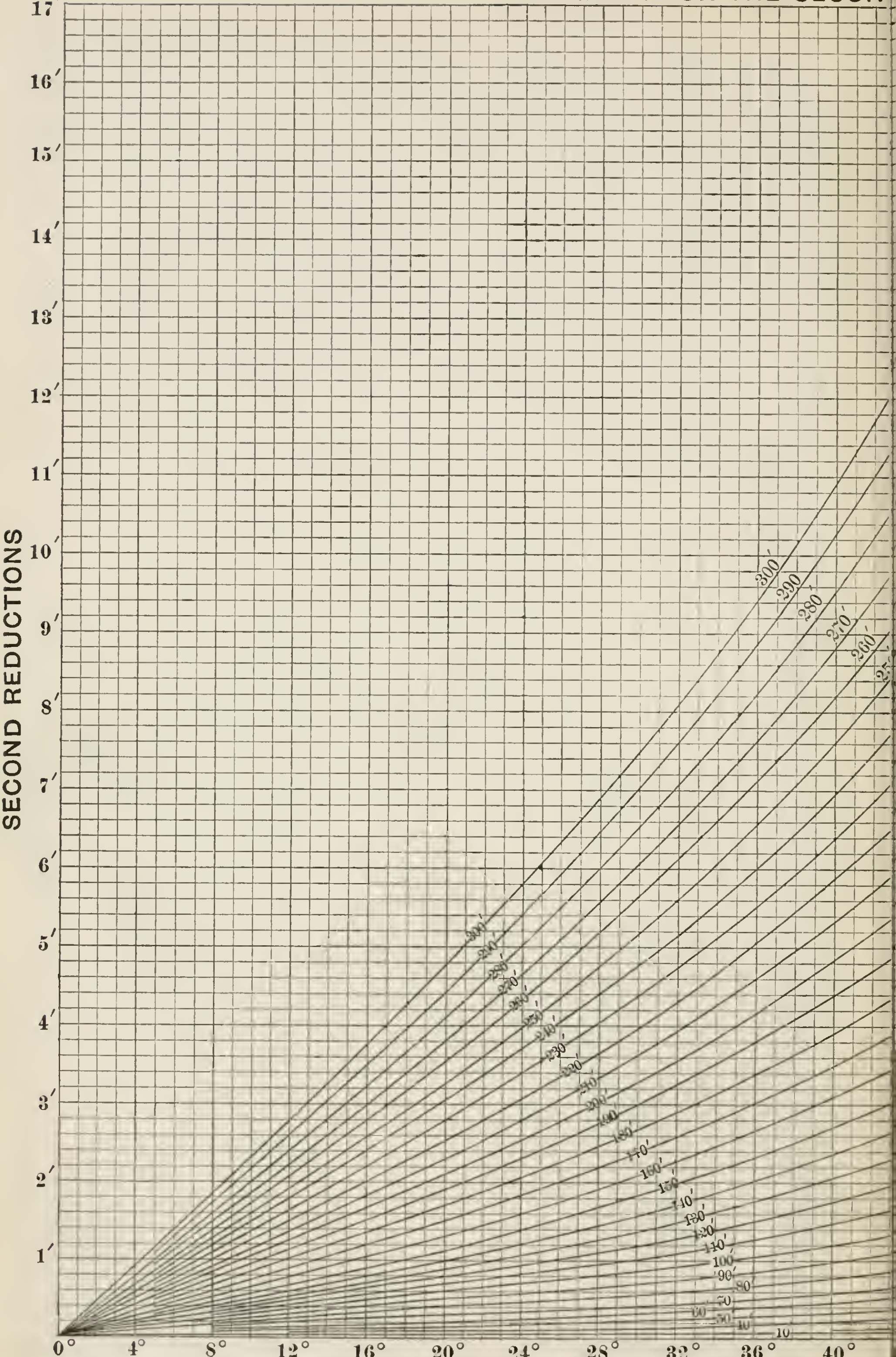
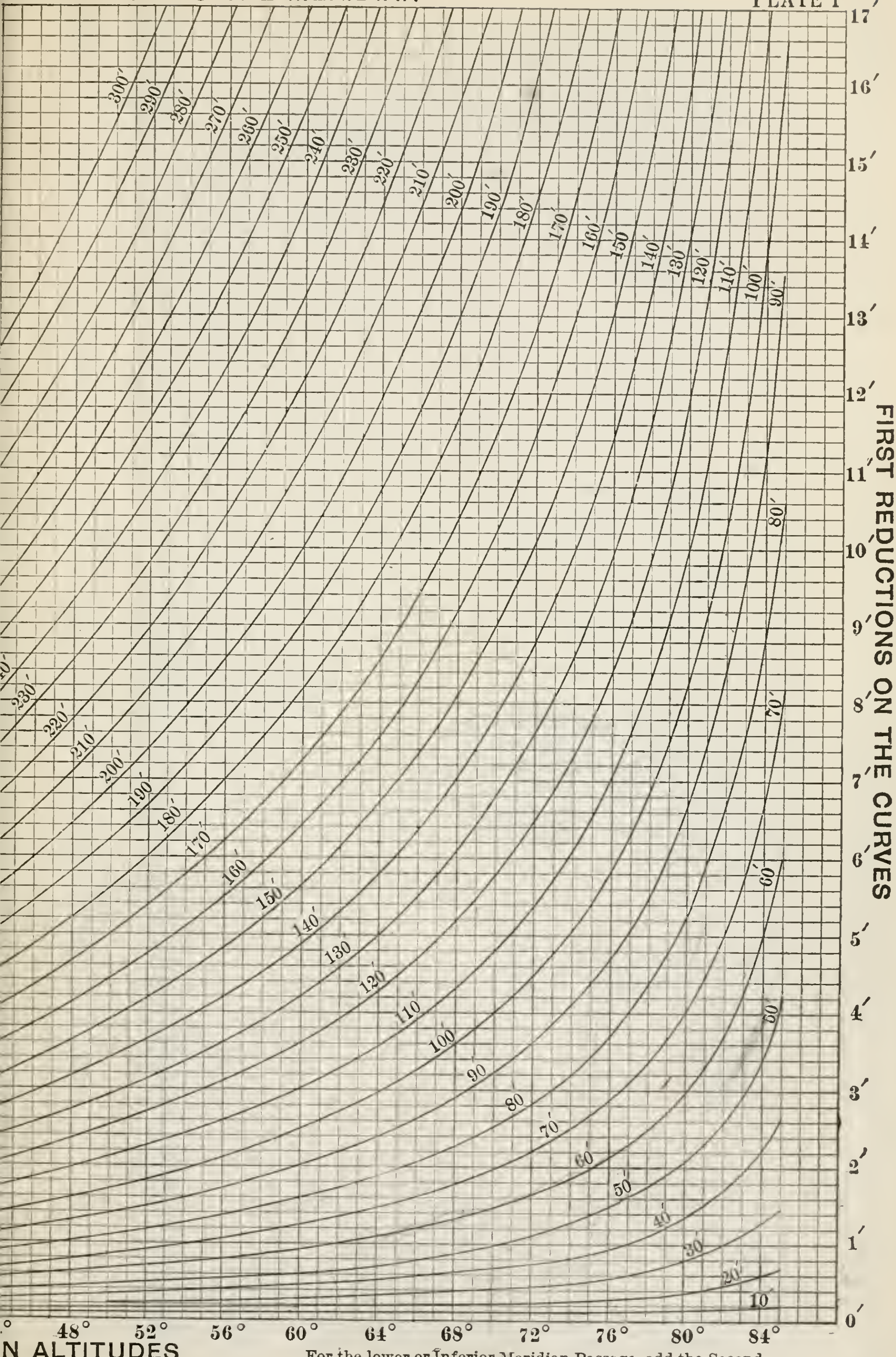
DIAGRAM FOR THE SECON



For the upper or Superior Meridian Passage; subtract the Second Reduction from the First Reduction

REDUCTION TO THE MERIDIAN

PLATE I



For the lower or Inferior Meridian Passage; add the Second Reduction to the First Reduction

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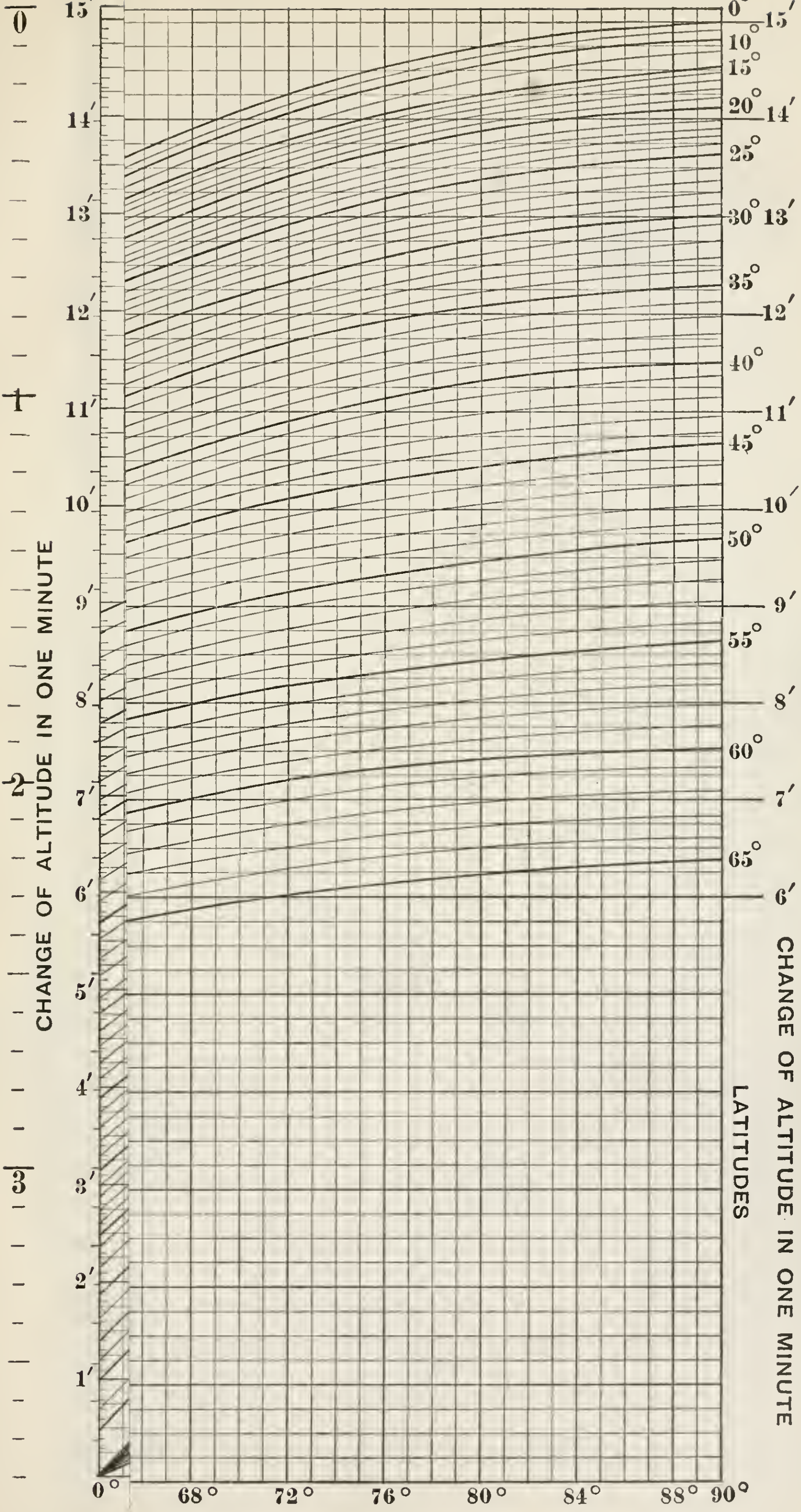
PLATE II.


CHANGE OF ALTITUDE IN ONE MINUTE
CHANGE OF ALTITUDE IN ONE MINUTE
LATITUDES
0
1
2
3
15′
14′
13′
12′
11′
10′
9′
8′
7′
6′
5′
4′
3′
2′
1′
0°
68°
72°
76°
80°
84°
88°
90°
0°
10°
15°
20°
25°
30°
35°
40°
45°
50°
55°
60°
65°
15′
14′
13′
12′
11′
10′
9′
8′
7′
6′

ALTITUDE-AZIMUTH DIAGRAM

PLATE II.

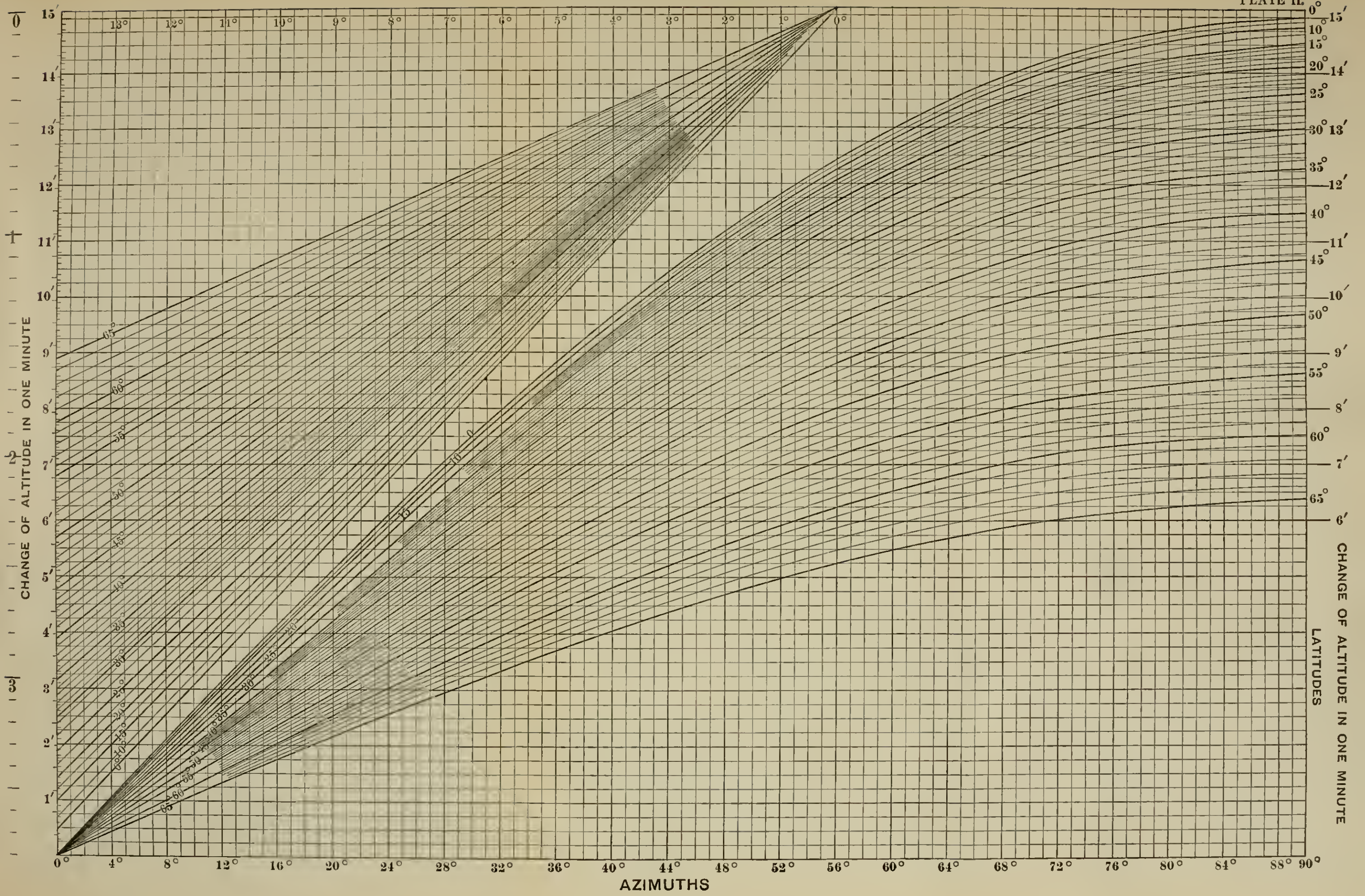
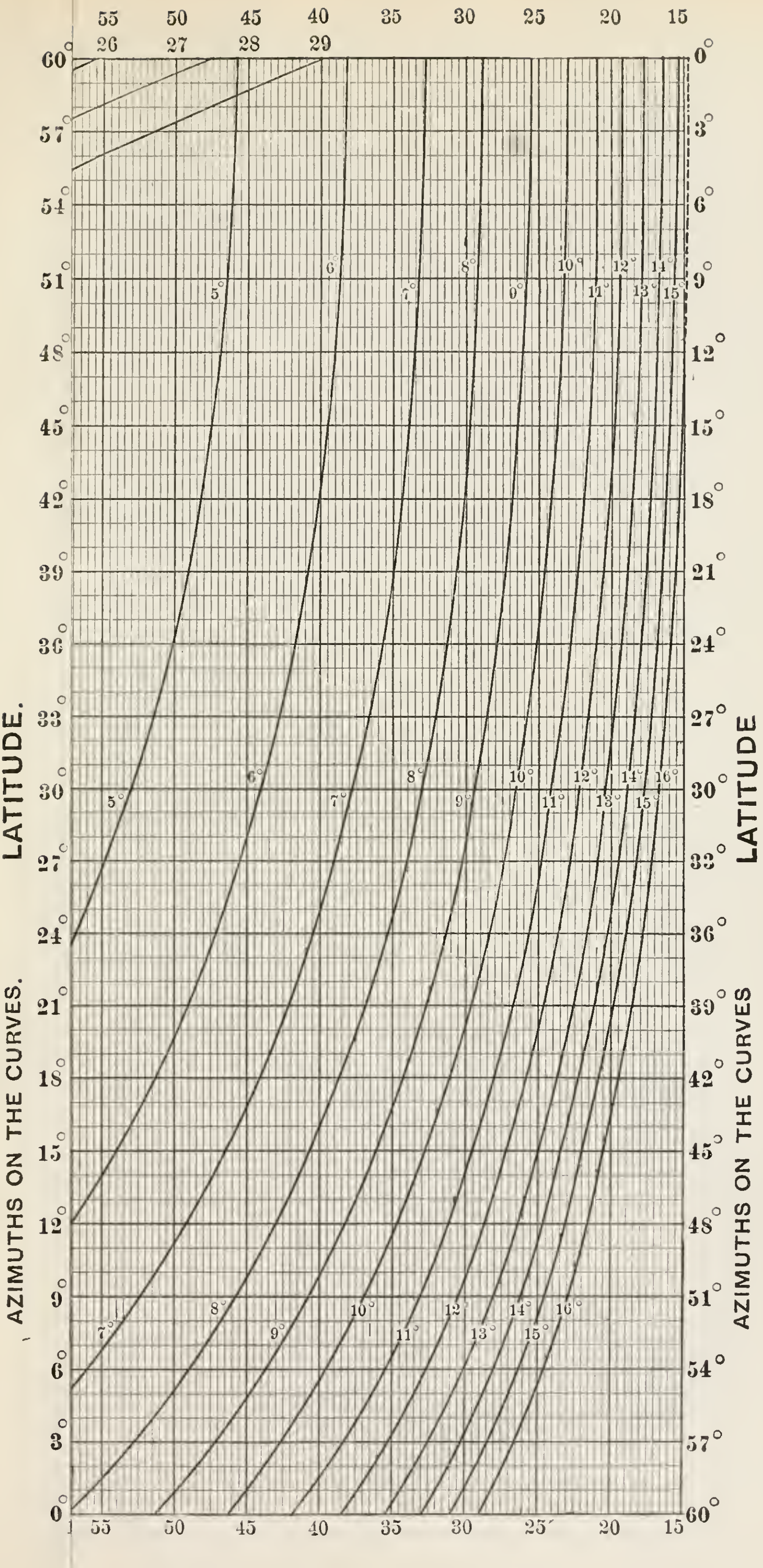
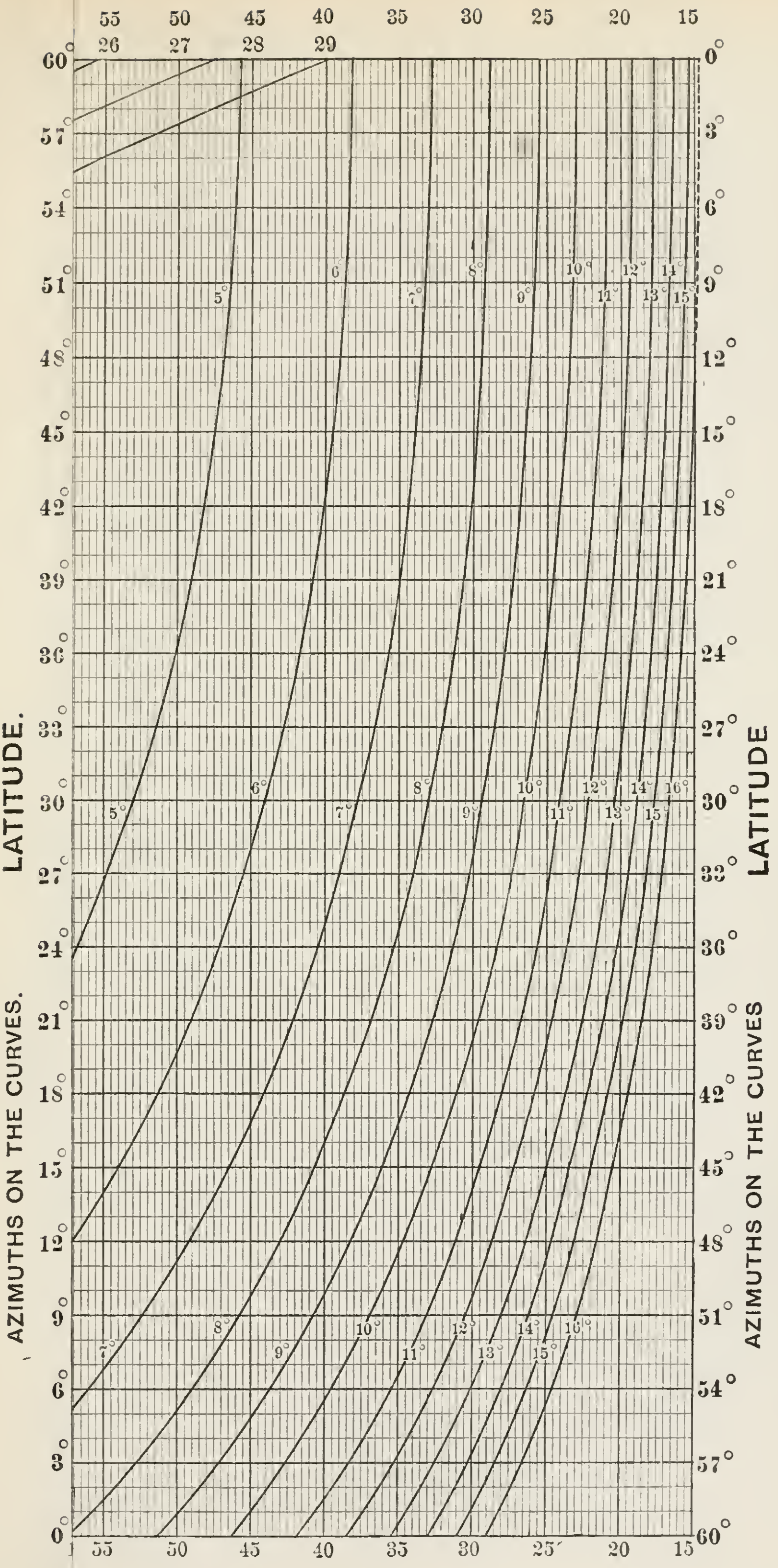


PLATE III



conds. When the time is found in the numbers which run from right to left use the margin; the corresponding Azimuth will be found on the curves between 16° and 2°.

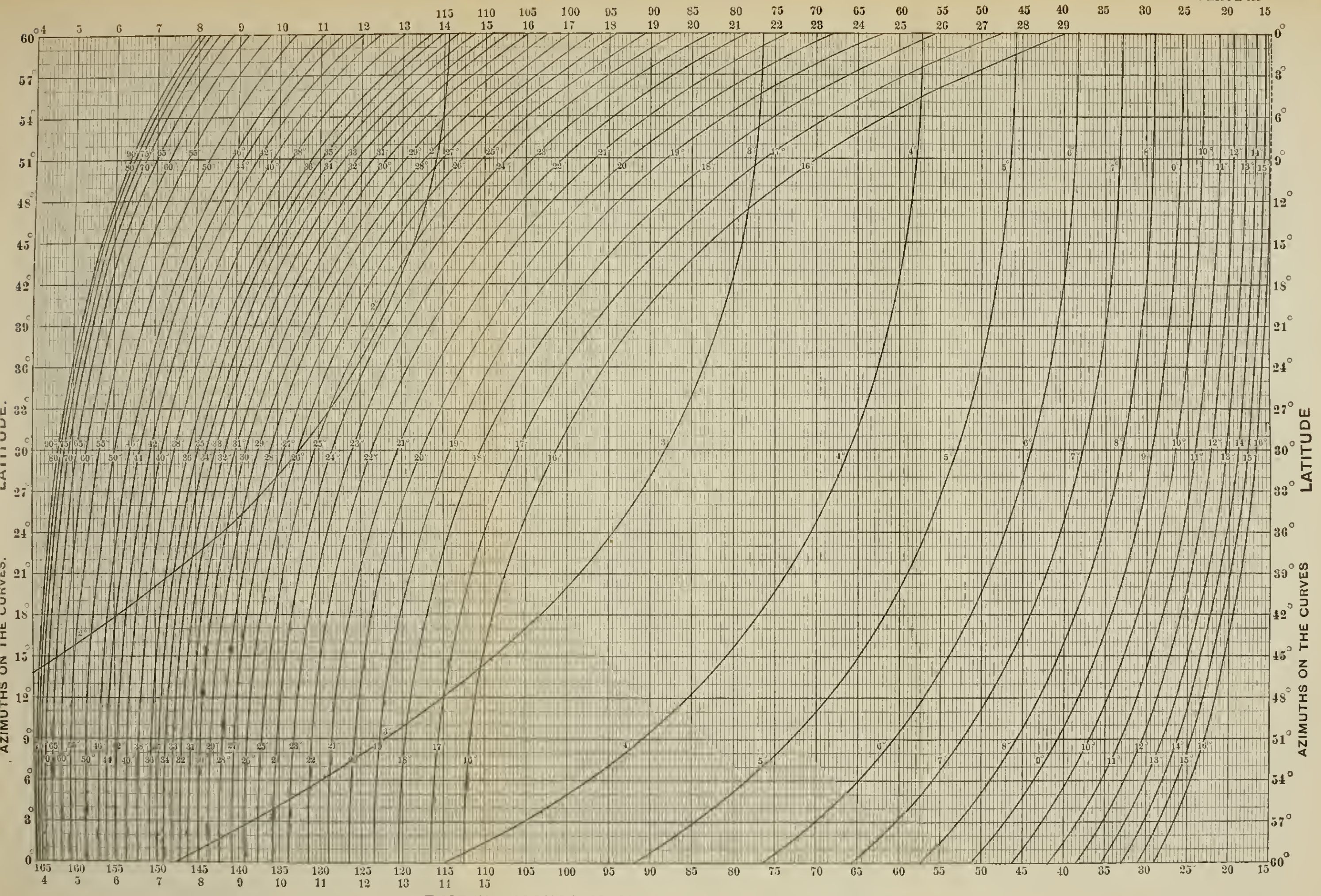
PLATE III



conds. When the time is found in the numbers which run from right to left use the margin; the corresponding Azimuth will be found on the curves between 16° and 2

TIME-AZIMUTH DIAGRAM.

PLATE III



There are two scales for seconds. When the time is found in the numbers which run from left to right use the Latitude on the left-hand margin; the corresponding Azimuth will be found on the curves between 90° and 16°.

There are two scales for seconds. When the time is found in the numbers which run from right to left use the Latitude on the right hand margin; the corresponding Azimuth will be found on the curves between 16° and 2°.

PLATE IV.

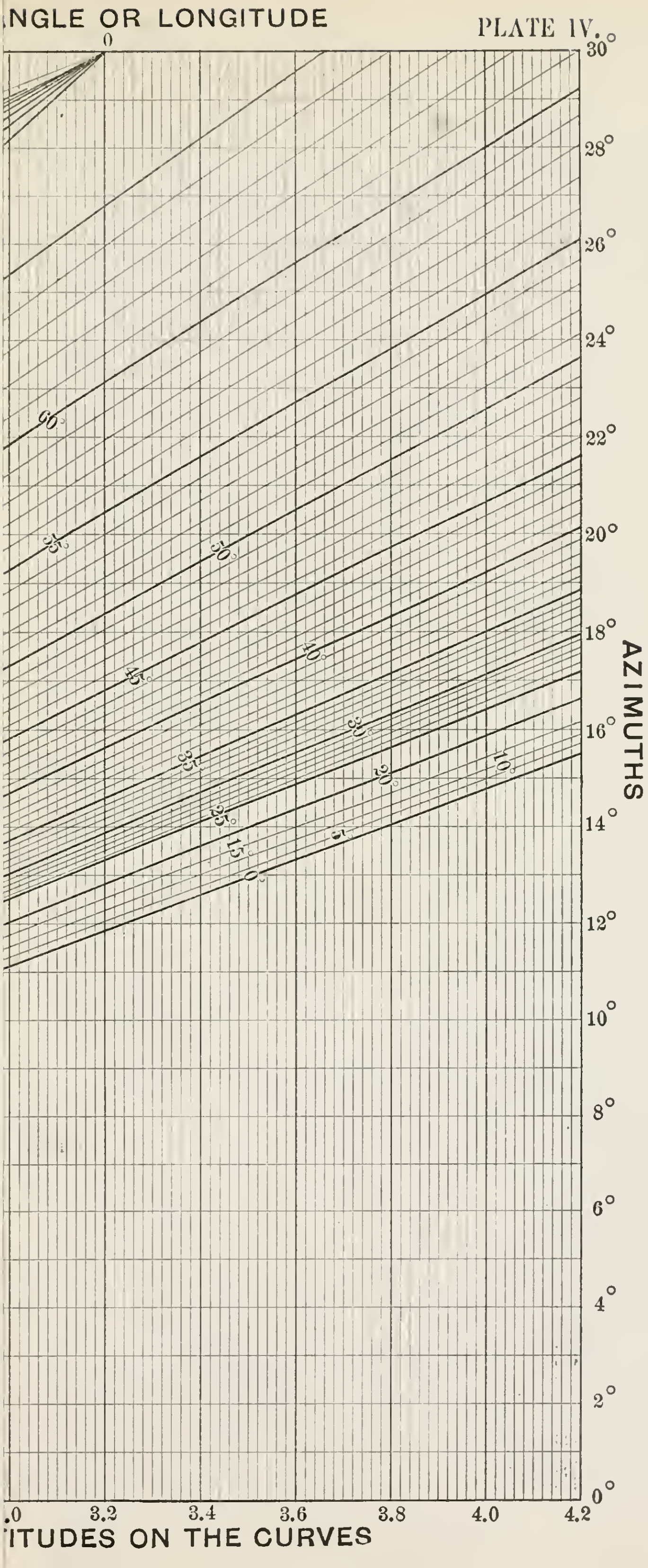
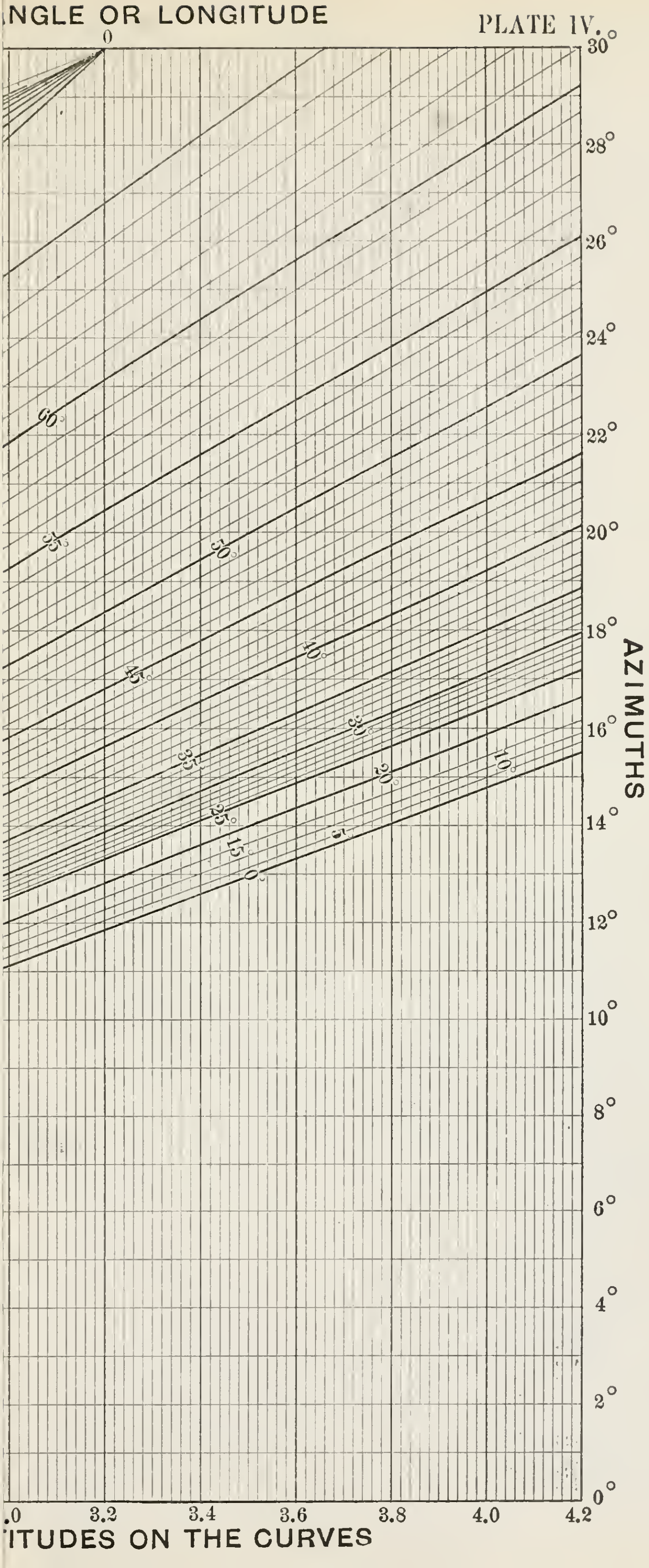
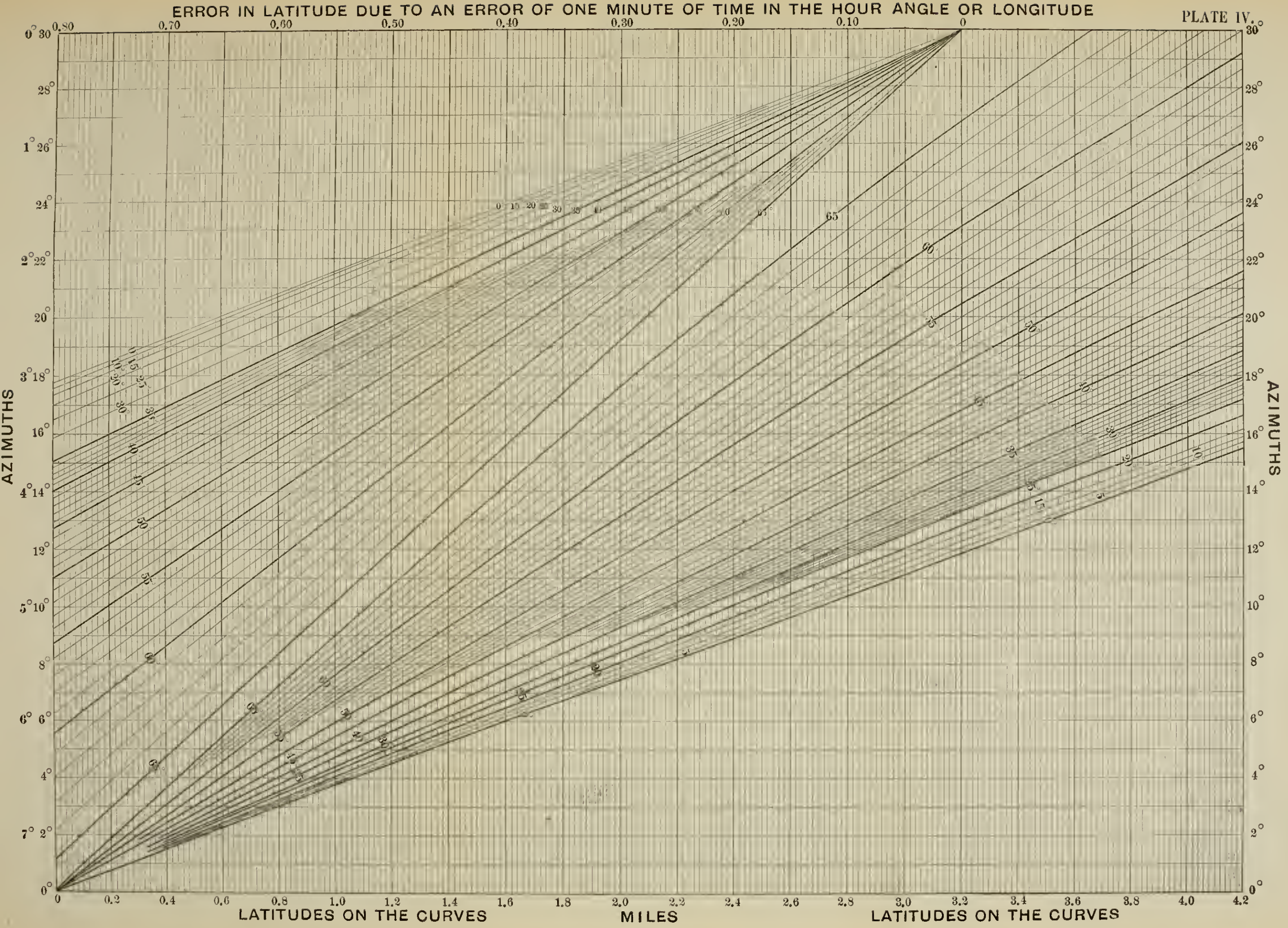

NGLE OR LONGITUDE
0
30°
28°
26°
24°
22°
20°
18°
16°
14°
12°
10°
8°
6°
4°
2°
0°
AZIMUTHS
60°
55°
50°
45°
40°
35°
30°
25°
20°
15°
10°
5°
0°
.0
3.2
3.4
3.6
3.8
4.0
4.2
ITUDES ON THE CURVES

PLATE IV.

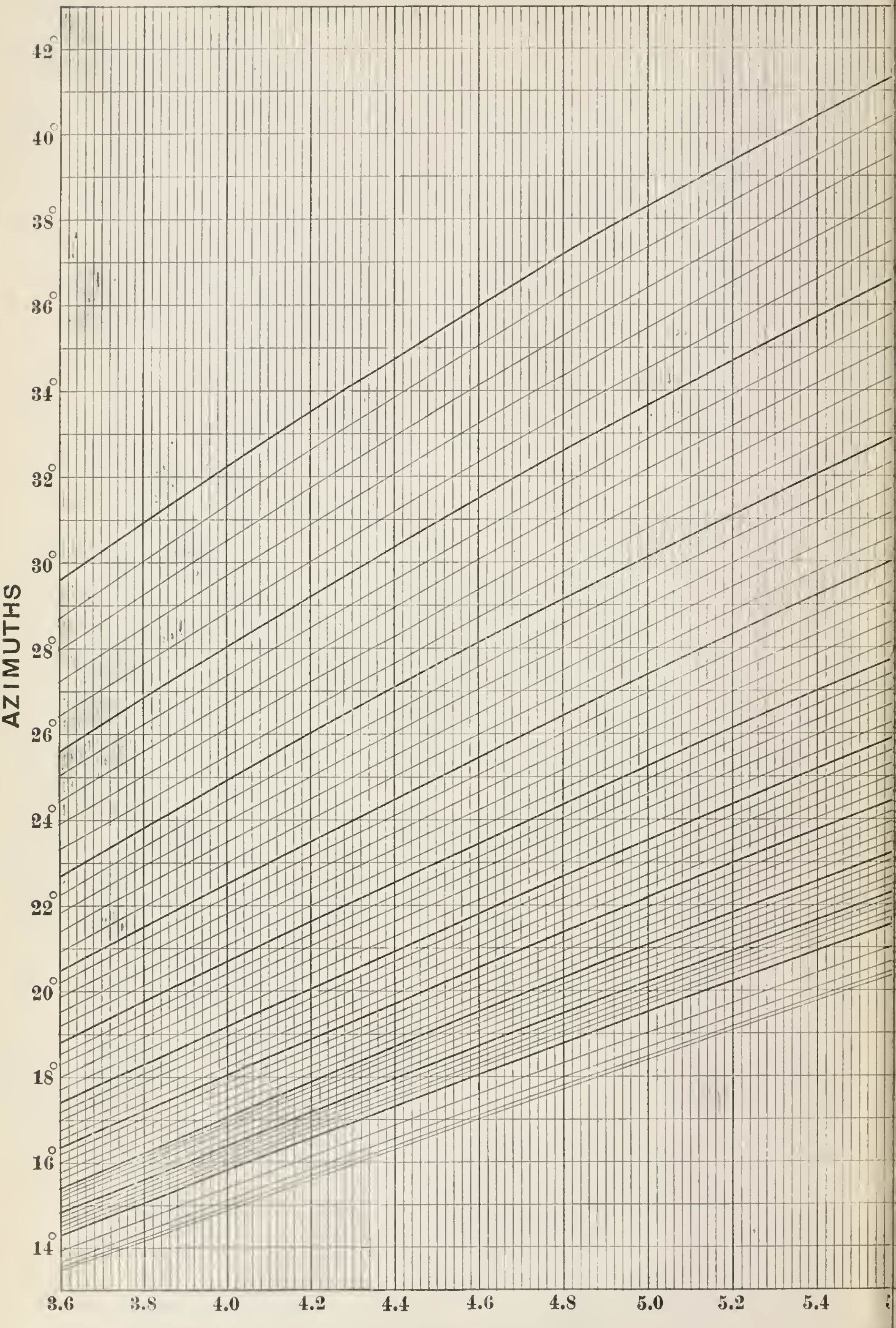


NGLE OR LONGITUDE
0
30°
28°
26°
24°
22°
20°
18°
16°
14°
12°
10°
8°
6°
4°
2°
0°
AZIMUTHS
60°
55°
50°
45°
40°
35°
30°
25°
20°
15°
10°
5°
0°
.0
3.2
3.4
3.6
3.8
4.0
4.2
ITUDES ON THE CURVES

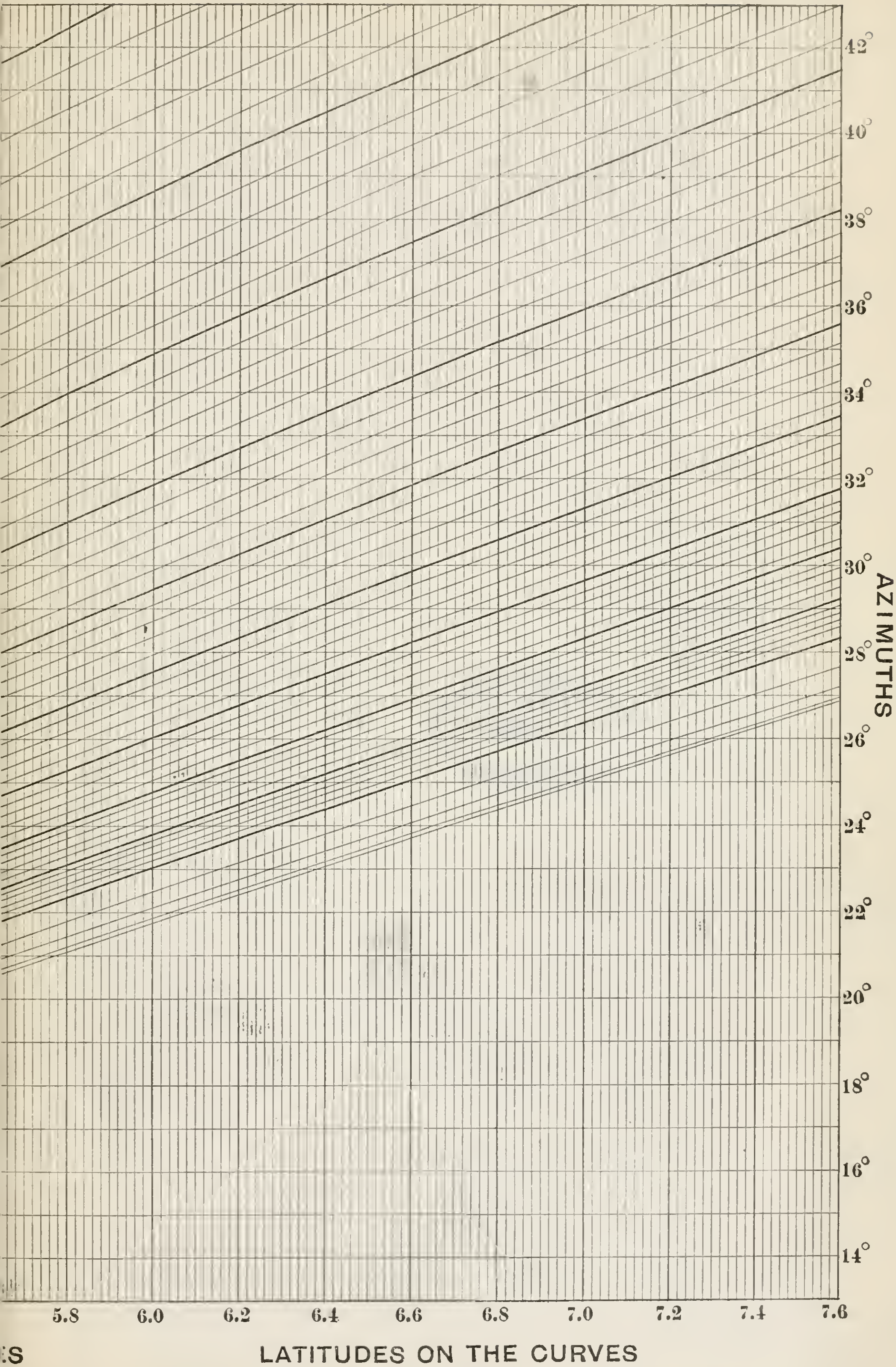
PLATE IV.


ERROR IN LATITUDE DUE TO AN ERROR OF ONE MINUTE OF TIME IN THE HOUR ANGLE OR LONGITUDE
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0
AZIMUTHS
0° 30°
28°
1° 26°
24°
2° 22°
20°
3° 18°
16°
4° 14°
12°
5° 10°
8°
6° 6°
4°
7° 2°
0°
30°
28°
26°
24°
22°
20°
18°
16°
14°
12°
10°
8°
6°
4°
2°
0°
AZIMUTHS
0
0.2
0.4
0.6
0.8
1.0
1.2
1.4
1.6
1.8
2.0
2.2
2.4
2.6
2.8
3.0
3.2
3.4
3.6
3.8
4.0
4.2
LATITUDES ON THE CURVES
MILES
LATITUDES ON THE CURVES
0 15 20 25 30 35 40 45 50 55 60 65°
65
60
55
50
45
40
35
30
25
20
15
10
5
0 15 25
10 20
30
35
40
45
50
55
60
65
60
50
40
30
65
50
40
45
30
25
20
5

ERROR IN LATITUDE DUE TO AN ERROR OF ONE M



NUTE OF TIME IN THE HOUR ANGLE OR LONGITUDE PLATE V.



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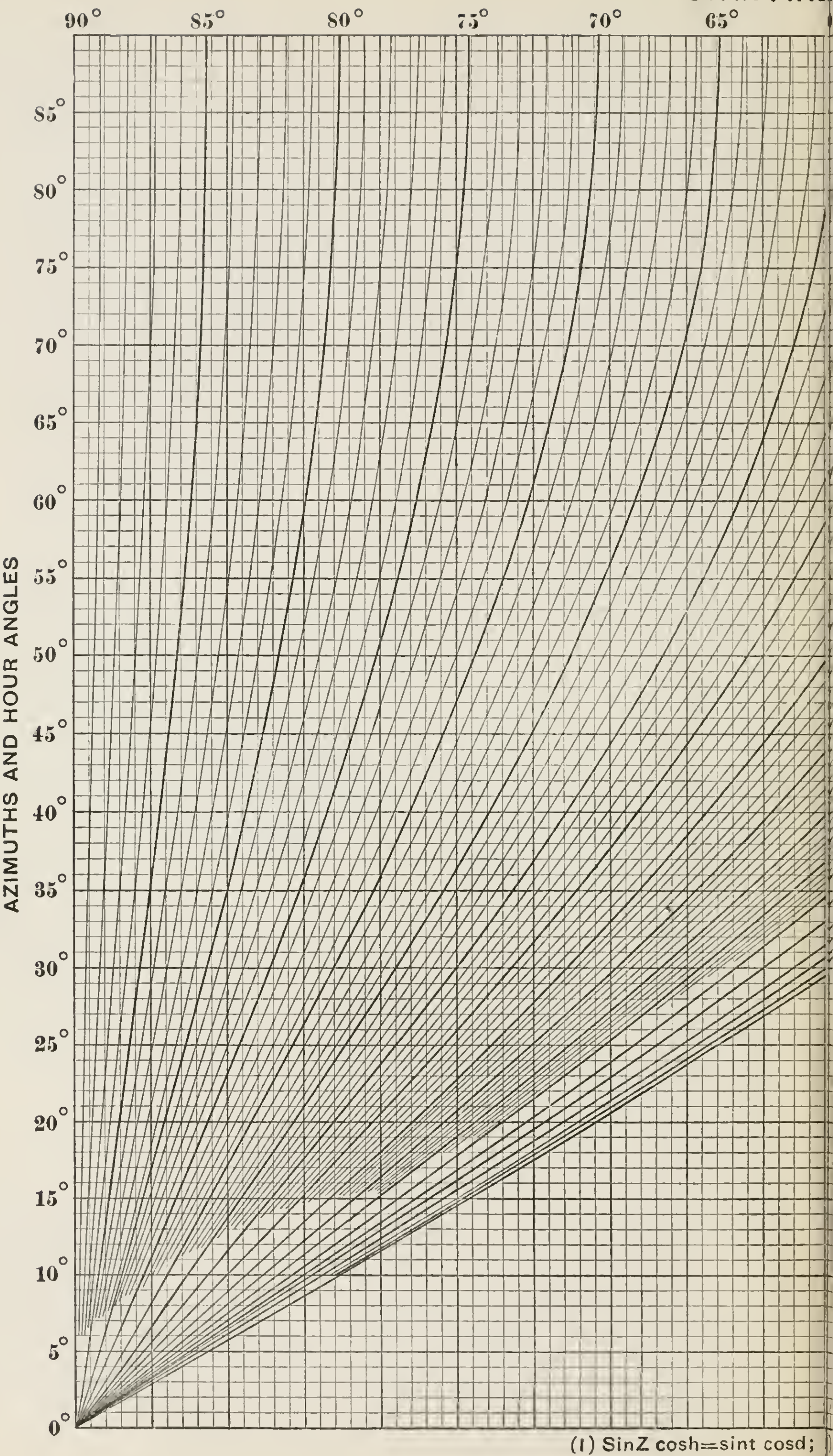
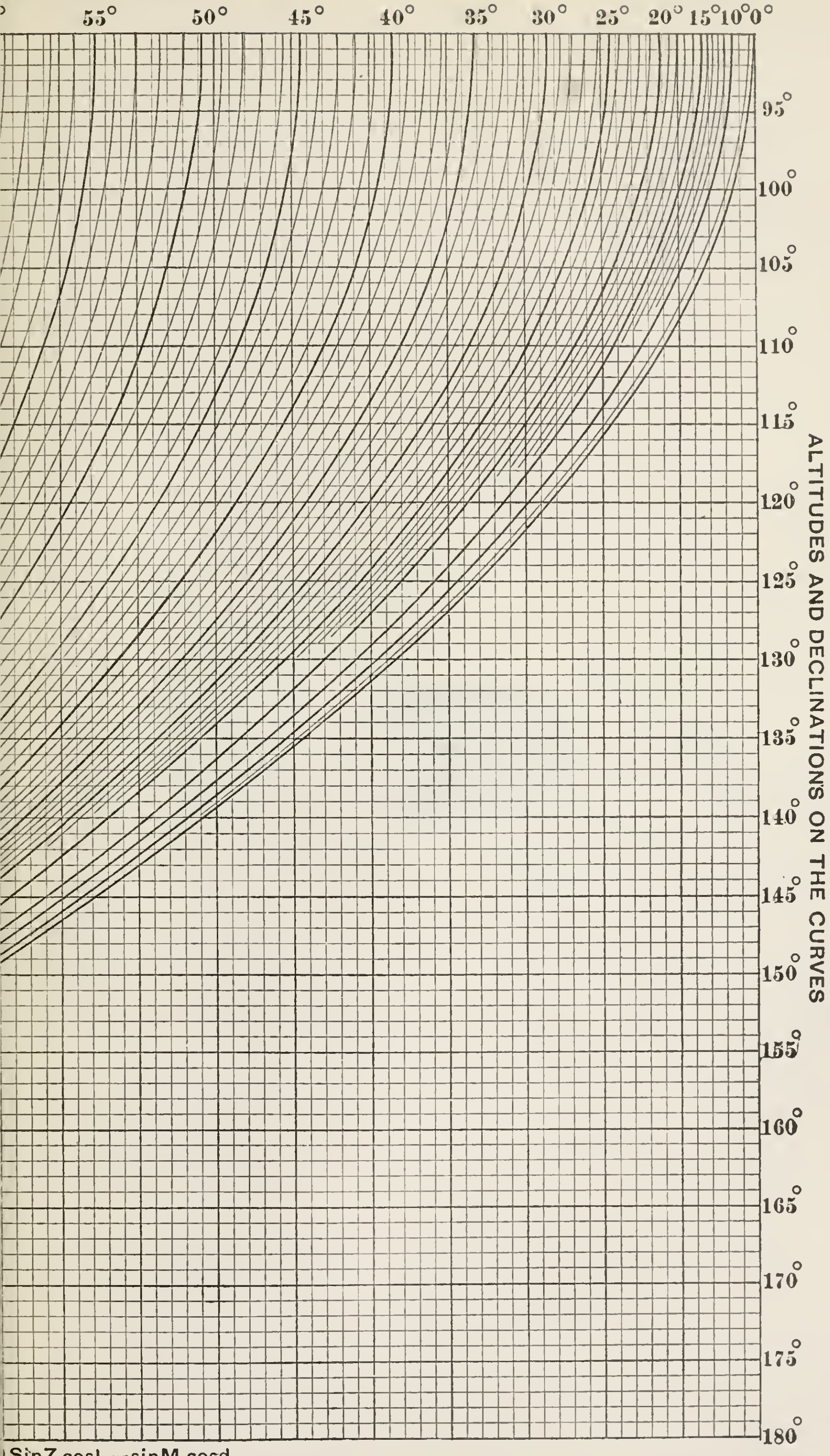


(1) $\sin Z \cos h = \sin t \cos d$;

NG DIAGRAM.

PLATE VI.



SinZ cosL = sinM cosd.

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